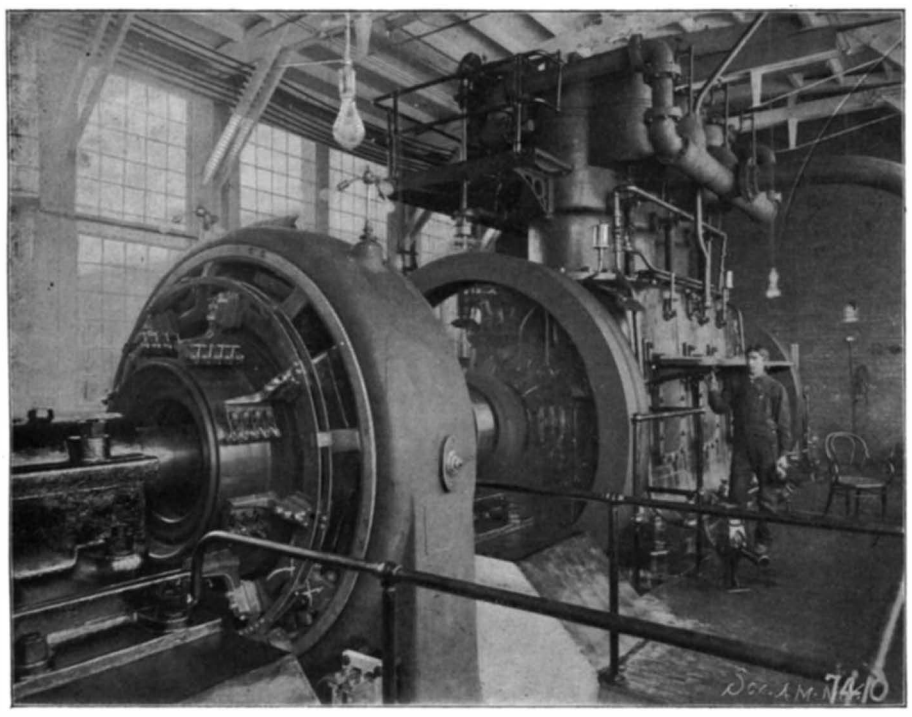
# SCIENTIFIC AMERICAN

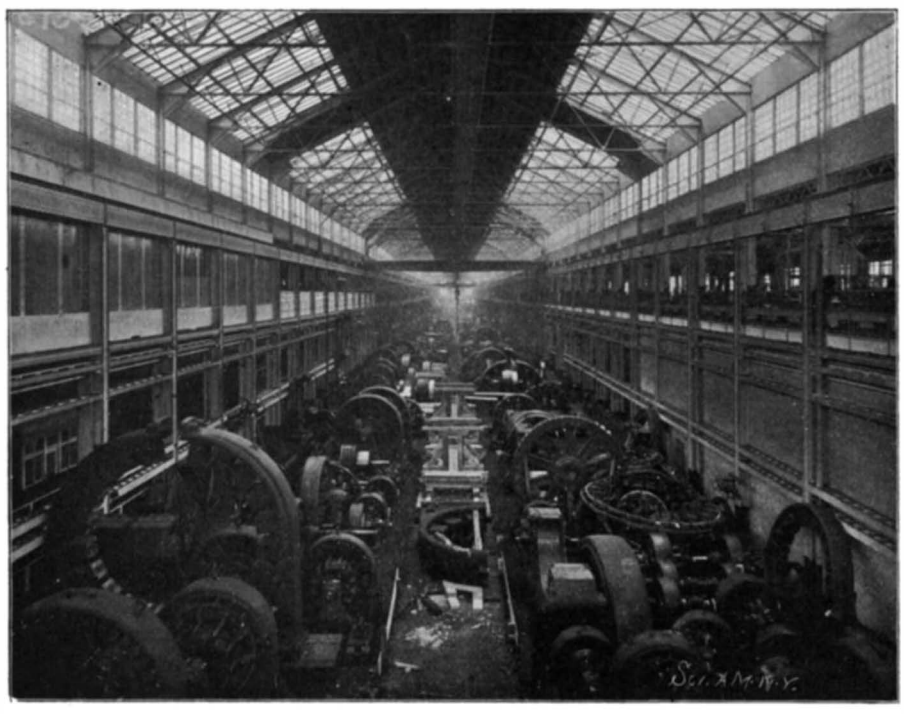
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1901, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXV.—No. 9. ESTABLISHED 1845. | NEW YORK, AUGUST 31, 1901. | $3.00 A YEAR. 8 CENTS A COPY.

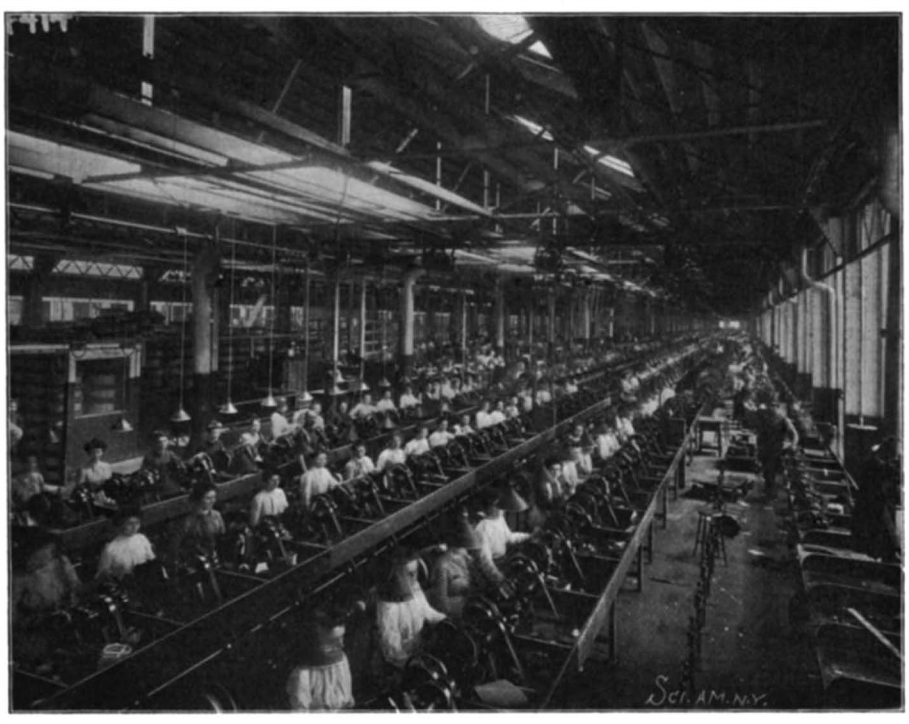



650-Horse Power Gas Engine Generating-Set in the Power Station.



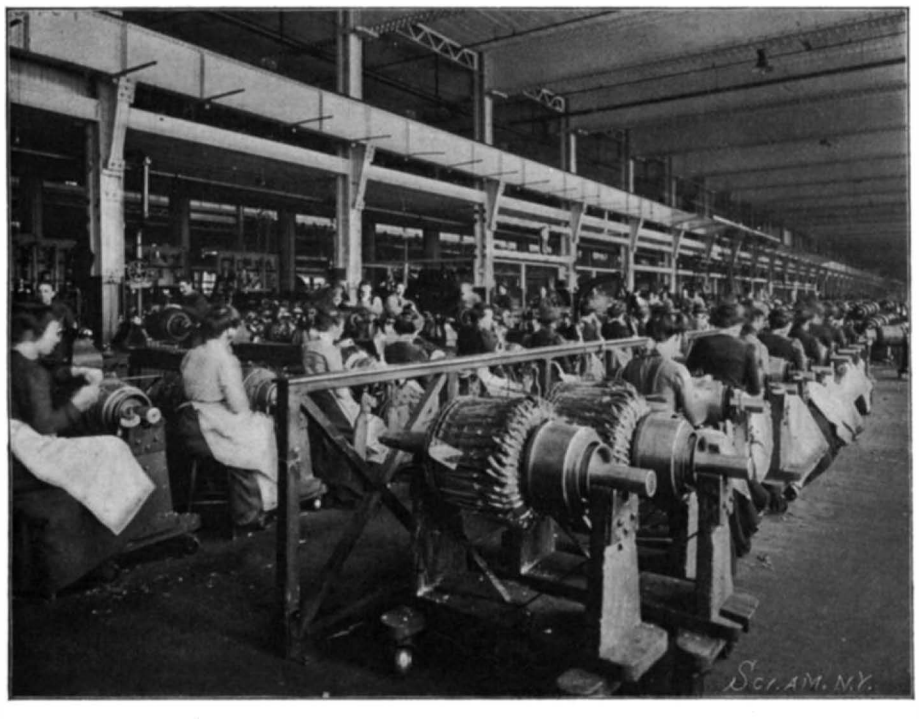
Heavy Construction Work in the Erecting Shops.

Mica-Splitting Machine.

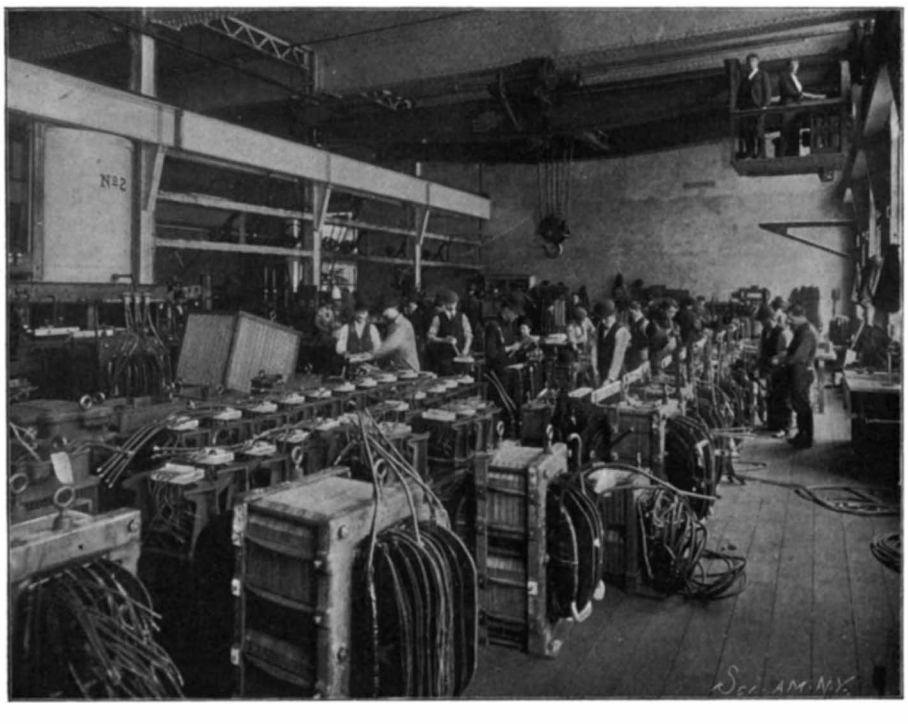


A Section of the Winding Department, Where Small Coils are Made.

Assembling Armature Cores.

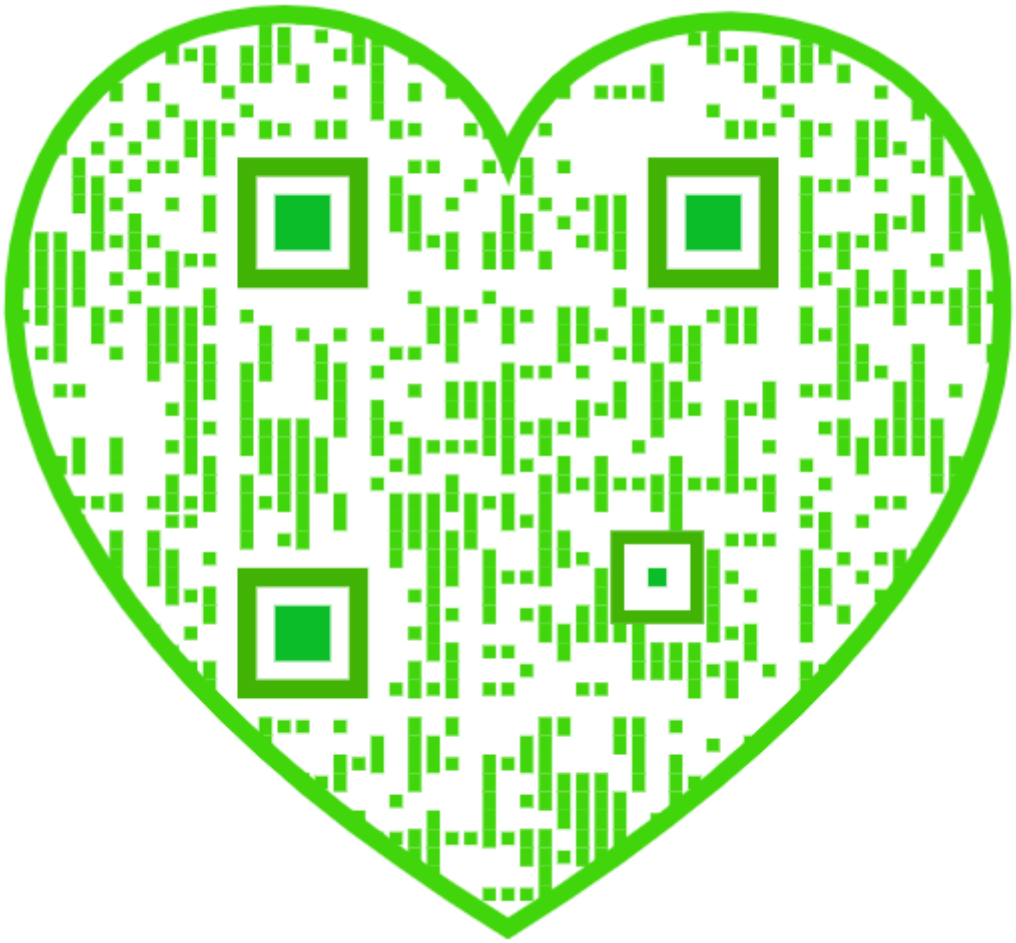


Connecting Street Railway Armatures.



Mounting Large Transformers.

INTERIOR VIEWS IN THE WORKS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.—[See Page 138.]



# Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

*TERMS TO SUBSCRIBERS*

One copy, one year, for the United States, Canada, or Mexico ..... $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

*THE SCIENTIFIC AMERICAN PUBLICATIONS.*

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 31, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


## GERMANY'S INDUSTRIAL CRISIS.

For the past few years the German press has been so loudly beating the commercial war-drum, and so cheerfully prophesying the ultimate triumph of young Germany over old England in controlling the markets of the world, that we can pardon the quiet exultation of the British manufacturers over the present financial straits in which their continental rivals now find themselves. The censors who have taunted the English manufacturer for his conservativeness and for his seeming inability to adapt himself to changing conditions are silenced for the moment.

Germany, which has ever been upheld as an example of all that is prudent and cautious, has overreached herself. The failure of one of the largest banks in the Empire and the severe drains to which the others are now subjected are the direct result of the over-production which began almost with German prosperity itself. The banks were only too ready to lend money for industrial purposes—so ready, indeed, that many of the factories in the Empire are either owned outright by the banks, or are heavily indebted to them. Works of all kinds sprang up; the banks furnished the money for tools and costly plants. While trade was brisk the works were busy enough filling orders, and no evil effects were apparent. But trade is never constant. At the first wave of dulness in the market the German manufacturers began to suffer. All ready money had been invested in shops, machinery, furnaces, tools. The banks clamored for the interest on their loans; but no money was forthcoming. Finally the Leipziger Bank failed for an enormous sum, dragged down by the firms to whom it had advanced money and who could not pay the interest on these advances. Other banks are now suffering from the financial depression which followed the building of more works than Germany needed to meet demands of the foreign buyers of her goods. Thousands of men have been thrown out of employment and promise to be a political thorn in the side of the government.

England has her mercantile traditions. She has developed and prospered by the observance of time-honored business rules which may now seem antiquated and inadequate, but which have at least proven themselves eminently safe. Countries that have grown up within the last century have profited by the splendid example of the British merchant, but, lacking his reverence for the past, and not content with a small but certain return from invested capital, they have been attracted by the larger but less certain profits of risky speculations, and have never fully learned the valuable lesson taught by Great Britain's unexampled prosperity. The United States, one of these younger nations, has entered on a new commercial era with all the impetuosity of youth, and has brought about new economical conditions. Without entering into any discussion of the social and economic aspects of the question of gigantic trusts, it may safely be stated that our industries are not likely to be crippled by over-production. So nicely does the trust regulate its output, and so effectually does it control the market, that a repetition of the German crisis in America should be impossible. At the same time the object-lesson is there, and as a people we shall do well to take note of it in this unparalleled era of industrial prosperity.

## VAST MUNICIPAL IMPROVEMENTS IN NEW YORK CITY.

New York city, the metropolis of America, and, as many of us believe, destined during the present century to become the metropolis of the world, is making expenditures for municipal improvements on a scale which it may safely be said has never been witnessed in the history of any city, ancient or modern. In the upbuilding of all great cities there have occurred remarkable periods of reconstruction and architectural embellishment, in which improvements that would ordinarily extend over several generations have been crowded into the brief limit of a single decade; but at no time, not even during the famous reconstruction of Paris, conceived and carried out under Napoleon III., was there witnessed the construction of such costly and varied works of improvement as are now being actively prosecuted in the city of Greater New York.

Naturally the largest appropriations from the city's purse are those made for providing New York with adequate rapid-transit facilities. The magnificent four-track tunnel which is now in process of active construction has been let at a contract price of $35,000,000, while the surveys are being made for an extension beneath the East River to Brooklyn which will call for an outlay of $8,000,000 more. Various elaborations of the original rapid-transit scheme, both in Manhattan Island and in Brooklyn, will bring the cost of the present scheme up to $50,000,000.

Next in importance to the underground tunnel, and intimately associated with it in the general scheme for improved transit, are the three great bridges which are now being built across the East River. The largest and most important of these, known as the East River Bridge, which is now within measurable distance of completion, will have cost, including the outlay in the purchase of real estate, something over $20,000,000. A mile below it and adjoining the old Brooklyn Bridge, another suspension bridge, known officially as No. 3, is being constructed which will have a river span of 1,500 feet and with its terminals will cost about $20,000,000; while to the north of the new East River Bridge, Manhattan and Queens will be united by a costly cantilever bridge which, with its unusually lengthy approaches, will consume not less than $22,000,000 of the city's funds before it is opened for public use. Although it has not yet passed the point of preliminary survey, there is every probability of the construction of a great North River Bridge, with a span of 3,100 feet, which will bring the railroad systems of the West directly into New York city. The unprecedented size of this structure and the costliness of the approaches and tunnels will bring its total cost to at least $60,000,000.

Of less magnitude, but of great importance as a means of improving transit facilities, are two bridges across the Harlem River, one between First Avenue and Willis Avenue and the other at 155th Street, the combined cost of which will be $3,500,000. Another important work closely allied to the rapid-transit problem is the construction of a system of boulevards and roadways. The most important branch of this work just now is the extension of Riverside Drive and Park, and the completion of the great viaduct over Manhattan Valley; for this the sum of $1,500,000 has been appropriated.

The provision of an adequate water supply for New York is entailing the expenditure of another $12,000,000 to $15,000,000. Five millions of this is being spent upon the Jerome Park Reservoir, $6,000,000 on the great Croton Dam and reservoir, and the balance is to be spent in improvements in other branches of the work which are under the care of the Water Works Commission. Eight and a half million dollars are being expended in the improvement of the system of parks through the city, and as much more in the opening and widening of streets.

The architectural improvements which are under way are secondary only in importance and cost to the great engineering works above enumerated. The new Hall of Records which is now under construction will, at its completion, cost over $4,000,000. In its engineering, architectural, and artistic features, it will be one of the most remarkable buildings in this country, and probably the best equipped for its purpose in existence. The New York Public Library, whose foundations are completed, is to cost another $4,000,000. Even more important in size and cost is the vast Museum of Natural History building, which is being carried out on the original ambitious plan. When it is completed it will cover an area equal to that of five short city blocks, and its cost will have reached the great total of $10,000,000. We think that the New York public scarcely realizes what a truly magnificent pile this is destined to be. On the southern side of Bowling Green there is being erected by the Federal Government a new Custom House which is to cost considerably over $5,000,000. This structure will probably be built of granite. Mention should be made here, also, of the great work of improvement that is being carried out by the government in deepening the entrance channels to New York harbor. For the new Ambrose Channel leading from the Narrows to deep water beyond Sandy Hook $4,500,000 has been appropriated; another $1,500,000 will be spent in deepening the Bay Ridge and Red Hook Channels off the Brooklyn shore; and the three channels together will provide a continuous 40-foot waterway from the New York and Brooklyn docks to deep water. To this great expenditure must be added $250,000 for the enlargement of Governor's Island.

Limits of space prevent any detailed reference to the vast sums which are being expended by private corporations and individuals. The new Stock Exchange, for instance, will cost $2,000,000, and $1,000,000 each is to be expended on a new building for the Chamber of Commerce and a new Maritime Building. Work is now progressing in the city on one departmental store which is to cost $3,000,000, and there are several others under construction which will cost something more than $1,000,000 apiece. The list of public works above enumerated serves to show upon what an enormous scale municipal development is being carried on, but there are omitted from the list a great number of buildings, chiefly of a commercial character, which in an earlier stage of the city's history, would, any one of them, have been considered worthy of extended remark. The total cost of the improvements which are projected and under active construction at the present time in this city is between $600,000,000 and $700,000,000.

## RAILWAY SYSTEMS OF THE UNITED STATES.

The last annual report of the statistician of the Interstate Commerce Commission indicates that the healthy growth of our railroad systems, which has been a marked feature of the past few years, has been maintained during the year ending June 30, 1900. The total length of single-track was 193,346 miles, an increase during the year of 4,051 miles, or more than that of any year since 1893. The aggregate length of railway track, including tracks of every kind, was 259,788.

The amount of railroad capital outstanding was $ 1,491,034,960, which represents a capitalization of $61,490 per mile. Of the total given, about $5,750,000 existed in the form of stock, while the funded debt was about $5,500,000. The amount of capital stock paying no dividend was $3,176,609,698, or 54.3 per cent of the total amount outstanding. The amount of dividends declared would be produced by an average rate of 5.23 per cent on stock on which dividend was declared.

For the operation of our roads there were required 37,663 locomotives, or 960 more than in the year preceding. The total number of cars of all classes in service was 1,450,838, an increase of 74,922. Of this total 34,713 were passenger cars and 1,365,531 were devoted to freight service. To operate the system required the services of 1,017,653 persons, an increase of 88,729 over the preceding year. This is the first year in the history of our railroads when the total number of employés has reached the million mark. To this great industrial army was paid out during the year $577,264,841 in wages and salaries, an increase of $131,756,580 over the amount paid during the fiscal year of 1895. The number of passengers carried during the year was 576,865,230, an increase over the previous year of 53,688,722. During the year 1,101,680,238 tons of freight was transported, an increase for the year of 142,000,000 tons. An analysis of these totals, both of passengers and freight, indicate that in both cases there was not merely a large increase, but an increase in the density of traffic. The gross earnings for the year were $1,487,044,814, and the income from operations was $525,616,303, an increase of $68,975,184.

The above statistics are true indications of the great prosperity which the country has been enjoying for the last two or three years, and the steady nature of the growth of our railroad systems as compared with the spasmodic and exaggerated growth of twelve or fifteen years ago affords hope that the present prosperity will be long continued. One could wish that the closing figures given in the report regarding the safety both of employés and passengers, particularly of the former, were less distressing, for we find that the total number of casualties on account of railroad accidents during the year reached the huge total of 58,185; 7,865 of these unfortunates being killed and the others more or less seriously injured. Of the railway employés 2,550 were killed, 39,643 injured. while of the passengers 249 were killed and 4,128 injured. The list of slaughter, however, does not stop here, for we learn that the total number of persons other than employés and passengers killed was 5,066, and that 6,549 were injured. In this list of figures are included trespassers, of whom 4,346 were killed and 4,680 injured. It does not need these figures to teach us that the tracks of a railroad company form a hazardous highway for foot-passengers; but we were certainly not prepared for the record of slaughter at highway crossings, 750 people being killed at these man-traps and 1,350 injured. The splendid body of men who are engaged in the active operation of our railroads evidently carry on their daily duties at enormous risk to life and limb, as we learn from the fact that one out of every 399 employes was killed during the year, and one out of every 26 was injured. We have become so accustomed to these records of railroad slaughter that they have lost much of their meaning to us, else there would surely be an outcry against such a sacrifice of life—such a cruel maiming, and

more or less complete disablement—as these figures indicate. We believe somebody once asked: "Is not the life of a man worth more than that of a sheep?" The story of killing which these statistics brings annually to our notice, almost leaves one in doubt as to what, in certain quarters, the answer might be. We are aware that automatic couplers have been introduced and made compulsory, largely with a view to preventing this loss of life; but in view of the fact that the railways are now so thoroughly equipped with them, we cannot help feeling disappointed that the casualty list shows so little signs of decrease. The United States people evidently do not realize the magnitude of this question. If they did, it would be agitated to the point at which some special inquiry would be made into the matter with a view to determining the cause of such a frightful loss of life, and the best means of preventing it. Fifty thousand injured and nearly 8,000 killed in a single year! We doubt whether the darkest records of the South African war would show a similar record in the same period of time.

## CHARLES SEDGWICK MINOT.

BY MARCUS BENJAMIN, PH.D.

For the first time in its history the American Association for the Advancement of Science will hold its meeting in the Rocky Mountain region, and to preside over the sessions to be held this week in Denver, Professor Charles S. Minot has been chosen to succeed Professor Robert S. Woodward as presiding officer. Thus the time-honored rule of a representative of one of the natural sciences following a representative of the physical sciences again prevails.

Professor Minot was born in West Roxbury, now a part of Boston, on December 23, 1852. As a boy, he began collecting insects, showing special interest in butterflies. In course of time he entered the Massachusetts Institute of Technology, where he graduated in the chemical course in 1872. Meanwhile he had published several entomological papers in which were descriptions of several new species. This led to an interest in the structure of animals, and as that interest developed he determined to devote himself to the study of biology. Finding it impossible to obtain the desired training in the United States, he went abroad and followed special studies at the universities in Leipzig, Paris, and Wurzburg, receiving the degree of Doctor of Science from Harvard in 1878.

In 1880 he became lecturer on embryology in the Harvard Medical School, and also instructor in that institution in oral pathology and surgery. These appointments he held until 1883, when he became assistant professor of histology and human embryology in the Harvard Medical School, and full professor in 1892, which chair he still holds.

While still a student in Leipzig, where he worked under Professor Carl Ludwig, whom he considers the best scientific teacher he ever knew, he made the discovery that muscles can maintain their contraction without forming carbon dioxide.

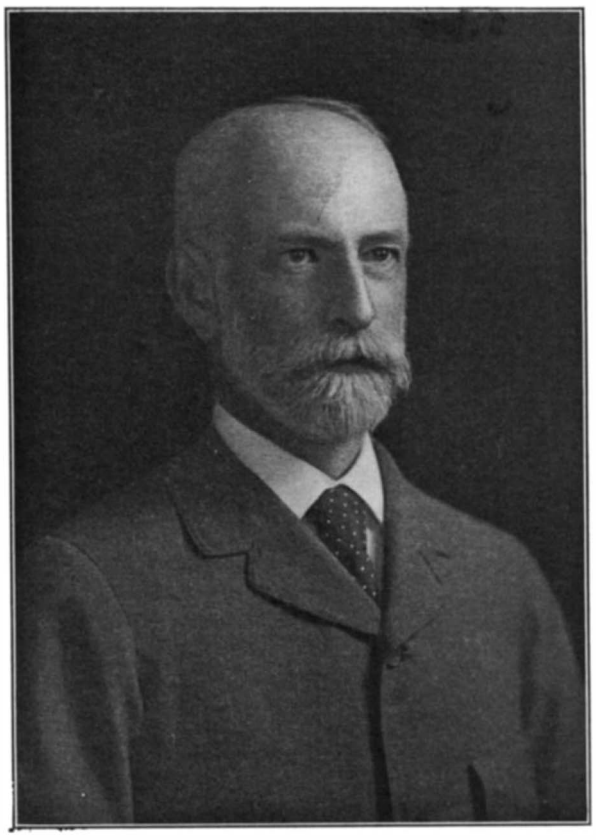
Other physiological papers followed the results of experimental investigations, and it was his ambition at that time to take up experimental biology, investigating such topics as growth, heredity, differentiation of tissues, etc. Of his work on growth it may be said that he discovered two important laws, first, that aside from minor fluctuations the power of growth diminishes from birth upward, there being no period in animals of development as opposed to decline; second, that the decline in the rate of growth is correlated with the relation and differentiation of the protoplasm of the cells. Embryological investigations, however, have become, during the last twenty years, more predominant, and his many papers have given the results of his various researches.

Another field of early study to which he devoted considerable attention was the structure of worms, and the most important general result of these investigations was his demonstration that the nemertean worms, which had always been classed with Platthelminths, formed a distinct class. He also devoted some attention to the microscopic anatomy of insects and invertebrates, publishing several papers on that subject, among which is an extended essay on the histology of the locust which appeared in one of the reports of the United States Entomological Commission.

In the practice of his work in the medical laboratory he has invented several important instruments, chiefly two microtomes originally described by him in 1897, but since improved, one of which he has designated as an "automatic wheel microtome" and the other as the "precision microtome," both of which have received favorable recognition among his colleagues.

To attempt any extended consideration of his bibliography would carry us beyond the limits of this brief sketch, and we must content ourselves with mentioning a few of the more important of his recent papers. Of these the "Work of the Naturalist in the World" was a presidential address delivered before the American Society of Naturalists at the annual meeting in Baltimore in 1894. In this he discussed the conditions of success in research, the effect of the naturalist's career on his character, and finally the influence of the naturalist on mankind. The subject of "Heredity and Rejuvenation" was attractively presented by him in the American Naturalist for January and February, 1896. He treated it under the following headings: The formative force of organisms, the conception of death, a comparison of larva and embryo, contending in conclusion that "heredity exists in all cells, but its display is inhibited by the organization of the living substance and can be complete only in embryonic cells, and that embryonic cells arise under very various conditions." Besides the foregoing he delivered the Yale University Medical Commencement discourse in June, 1899, on which occasion he addressed the students on the important subject of "Knowledge and Practice." In March of the present year he gave the Middleton-Goldsmith lecture before the New York Pathological Society, choosing as his subject the "Embryological Basis of Pathology." His entire bibliography numbers considerably over a hundred titles, and he is the author of a single book published in 1892 on "Human Embryology."

He has been actively connected with many scientific societies, being one of the founders of the Society of Naturalists in the United States, and for many years he has been a member of the Boston Society of Natural History, of which he became president in 1897. It was largely through his exertions that the American Society for Psychical Research was organized, and to the proceedings of which he has contributed a number of papers, resulting in his becoming satisfied that "there is no valid evidence for telepathy phantasms, or spirit communications." He is also a member of the American Academy of Arts and Sciences, of the New York Academy of Sciences, of the American Philosophical society, and a corresponding member of the British Association for the Advancement of Science. In 1897 he received an election to the National Academy of Sciences, which is the highest honor that can be given to an American scientist by his associates.



CHARLES SEDGWICK MINOT.

Doctor Minot became a member of the American Association at the Saratoga meeting in 1879. A year later he was made a fellow, and in 1885 was general secretary of the association. He affiliated himself with the section on biology, of which in 1890 he became vice-president, delivering at the Indianapolis meeting an address on "Certain Phenomena of Growing Old," in which he contended that the growth of protoplasm was the most characteristic peculiarity of advancing age, drawing his facts almost entirely from the study of vertebrates. At the New York meeting, held last year, he was the unanimous choice of the Council for the presidency.

## EXPORTS TO PORTO RICO.

Exports of American products to Porto Rico in the fiscal year just ended were, according to the figures of the Treasury Bureau of Statistics, more than three times as great as they averaged when Porto Rico was under the Spanish flag, and more than 50 per cent in excess of those prior to the enactment of the Porto Rican tariff law which went into effect May 1, 1900. The total domestic exports from the United States to Porto Rico in the fiscal year 1897, which entirely preceded the beginning of hostilities with Spain, were $1,964,850. In the fiscal year 1900, ten months of which preceded the date at which the Porto Rican tariff went into effect, our domestic exports to Porto Rico were $4,260,892. In the fiscal year ending June 30, 1901, all of which was under the Porto Rican act which levied 15 per cent of the regular Dingley law rates on goods passing into that island from this country, the total domestic exports from the United States to Porto Rico were $6,861,917. These figures include only exports of domestic merchandise, and do not include foreign merchandise brought into the United States and re-exported to Porto Rico, which presumably amounted to about a half million dollars, since the Porto Rican statement of imports from the United States for the fiscal year ending June 30, 1901, shows the grand total, including domestic and foreign, to be $7,414,502.

Porto Rico imported in the fiscal year ending June 30, 1901, goods amounting to $9,367,230 in value, and of this, $7,414,502 came from the United States, the total from other countries being $1,952,728. Of this $1,952,728 imported from countries other than the United States, the value of $808,441 was from Spain; $374,837 from the United Kingdom; $294,067 from Canada; $166,723 from France; $152,201 from Germany, and $61,838 from the Netherlands.

The total exports of the island during the fiscal year 1901 were $8,663,816, of which the value of $5,661,137 was sent to the United States, and $3,002,679 to other countries. Of the latter sum, the value of $1,110,048 was to Cuba; $596,023 to Spain; $473,070 to France; $341,699 to Canada; $140,772 to Germany, and $88,935 to the Netherlands.

The growth in exports from the United States to Porto Rico has been in nearly all the articles entering into that commerce, but especially in manufactures. Exports of cotton cloth increased from 5,500,000 yards to over 22,000,000; boots and shoes, from 23,000 pairs to 48,000; books, maps and engravings, from $14,000 to over $40,000; candles, from 111,000 to 375,000 pounds; chemicals, drugs and medicine, from $59,000 to $89,000; wearing apparel, from $23,000 to $101,000; vegetable oils, from $53,000 to $66,000; soap, from $17,000 to $27,000; the manufactures of wood, from $49,000 to $100,000. There was a slight reduction in exports of flour, probably due to the very heavy increased exportation of rice from this country, which advanced from less than 5,000,000 pounds to over 36,000,000 pounds. Provisions increased nearly $100,000 during the year, the exports during 1900 having been $870,897, and those of 1901, $961,001, and refined sugar increased in exportation from $6,211 in 1900 to $14,684 in 1901.

## ADVANTAGES OF PAPER NEGATIVES.

The use of bromide paper for the direct production of negatives is one which recommends itself to the amateur for various reasons. Prints made with such negatives are sharper than might be supposed. The lines are softened and many small details are suppressed, while the paper gives a slight grain to the print. While in many cases this would be a disadvantage for landscapes or portraits and such subjects not requiring great sharpness, it answers very well, especially for the larger sizes, from 5 x 7 inches and upward; in the larger prints the grain appears smaller, and the softening of the image in many cases adds to the effect. This is especially so in the case of a platinum print. The paper negative, besides, presents several decided advantages: First, it costs three or four times less than a plate, giving an economy which will be appreciated; second, it is easier to retouch, either on the front or back, without any special preparation, varnishing, etc., as in the case of a plate; third, halation of the negative is suppressed. Besides, the production of such negatives present no difficulty. The paper is placed with the back against a clear glass plate, and the whole is put in the holder; in most cases the paper will keep itself in place, or in others it may be put between two glass plates. The exposure is, of course, somewhat longer than for a rapid plate; this may be easily found by one or two trials. As to the development, it should be somewhat pushed, as the opacity of the paper makes it rather difficult to examine by transparence, and it cannot, of course, be examined from the back; but this is a minor difficulty. To make the print, the paper should be oiled, which increases its transparence and diminishes the grain; vaseline or nearly any oil will suffice. In this way some very fine prints have been made which have an artistic character resembling photogravures. The process is such a simple one that it is well worth a trial.

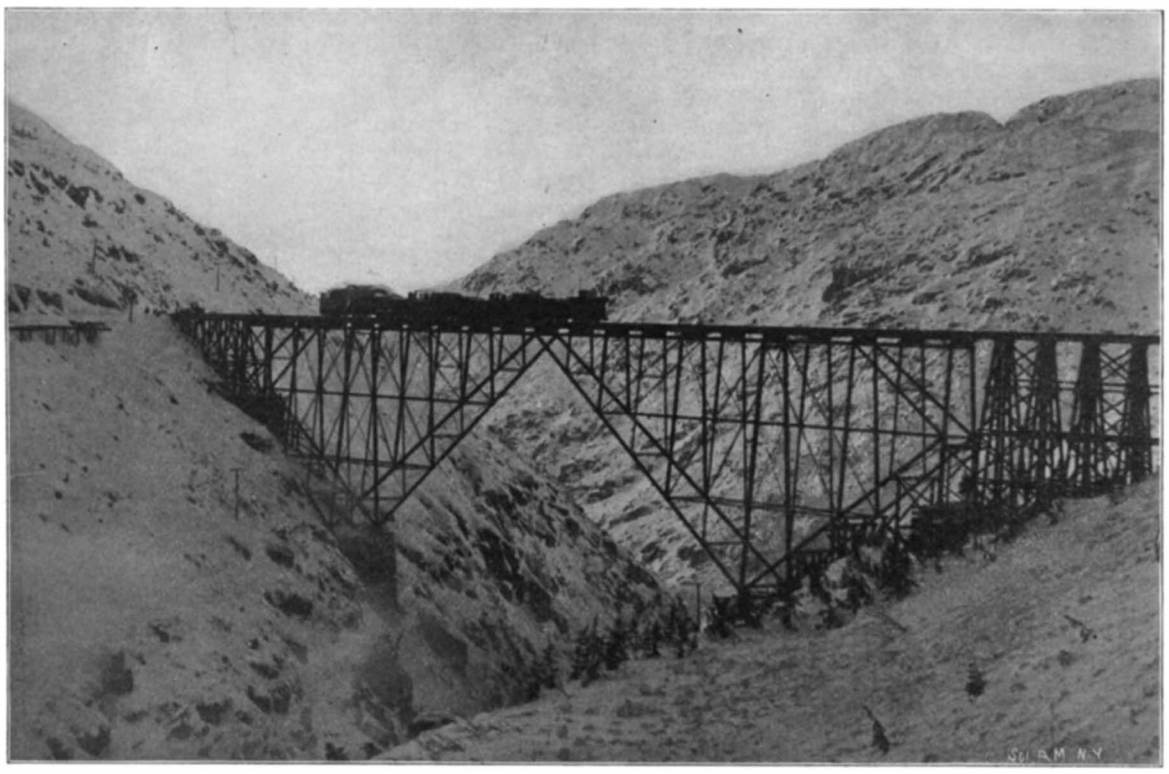
Dr. Doty's crusade against mosquitoes on Staten Island is succeeding very well. A little oil is sprinkled on the grass or weeds about 10 feet away from the houses. The inhabitants in the mosquito-ridden district claim that for the first time in weeks they were able to enjoy a good night's rest. The treatment of the ponds with petroleum seems to have also lessened the evil.

## CANTILEVER BRIDGE ON THE WHITE PASS AND YUKON RAILROAD.

At the time of the construction of the White Pass and Yukon Railway from Skagway, over the White Pass, the topography of the country necessitated the construction of a switchback about two miles to the south of the summit of the pass, for the purpose of carrying the line around a deep cañon at that point. The plans of the road contemplated the construction of a bridge; but the desire to get the road quickly completed led to the postponement of the bridge and the building of the more-quickly-constructed switchback. Although the latter construction enabled the road to be opened more quickly than it could otherwise have been, the many inconveniences of operation and the expense of maintenance determined the company to put in the bridge with as little delay as possible. The accompanying photograph shows the cantilever with which the cañon at this point is spanned. The clear span of the bridge is 240 feet, and the total length of the cantilever structure is 400 feet. At each end of the bridge proper is a wooden trestle, the total length of the crossing being 850 feet. At the center of the bridge the rails are 275 feet above the bottom of the cañon. Considerable difficulty was experienced in building the concrete foundation piers of the cantilever, which had to be built on the steep, sloping slides of the cañon; and in excavating the foundations a large amount of ice was encountered in the crevices of the rocks, all of which had to be carefully removed. The bridge was built by the Puget Sound Bridge and Dredging Company, Seattle, Wash., and the work was commenced in August, 1900. The cantilever system of construction was adopted because of the difficulty and cost of erecting falsework over a cañon of such great depth. The shore arms were erected upon falsework in the customary way, and then the outer arms, bridging the cañon, were constructed on the overhanging system, a movable traveler, carried on the deck of the completed structure, serving to handle the members of the bridge and swing them into position.

A test of the bridge was made in January of this year with a train which consisted of two engines and five carloads of steel, (there being about 15 tons on each car), a caboose and one passenger coach. A rotary snowplow and two of the heaviest engines of the road were also run over the structure. In carrying out the test a series of level rods was placed on the floor beams, at the panel points of the bridge, and observations were taken with a level stationed on the adjoining hillside. The first test was made by pushing five carloads of rails onto the bridge, with the engine advanced upon the bridge only by the length of one panel. The greatest deflection of this loading was observed at the position occupied by the engine, where it amounted to one-quarter of an inch. In the next test the engine was run out to the center of the bridge and then across the bridge and back again, when a maximum deflection of a quarter of an inch was observed throughout the middle third of the structure. Another test was made by coupling two engines together. This gave a maximum deflection of three-eighths of an inch throughout the middle third. The next test was made with a rotary snowplow and two engines coupled together. This load was heavier than that of the rail train, but of the same length, and it gave a maximum deflection of five eighths of an inch at the center of the bridge and three-quarters of an inch at the third panel from the center each way.

Compared with other cantilever structures of considerable height, the White Pass and Yukon Railway bridge is distinguished by the fact that each cantilever is made so deep that a separate carrying tower is not required, the bottom chords of the two arms of each cantilever meeting at the foundation. This system of construction reduces the stresses on the bottom chord, and the great depth of the cantilever conduces to vertical stiffness. When the eye becomes accustomed to the design, it must be confessed it is by no means unpleasing, and the cost of the bridge per foot must be somewhat cheaper, we imagine, than that of a cantilever built with the customary towers and arms of less depth.

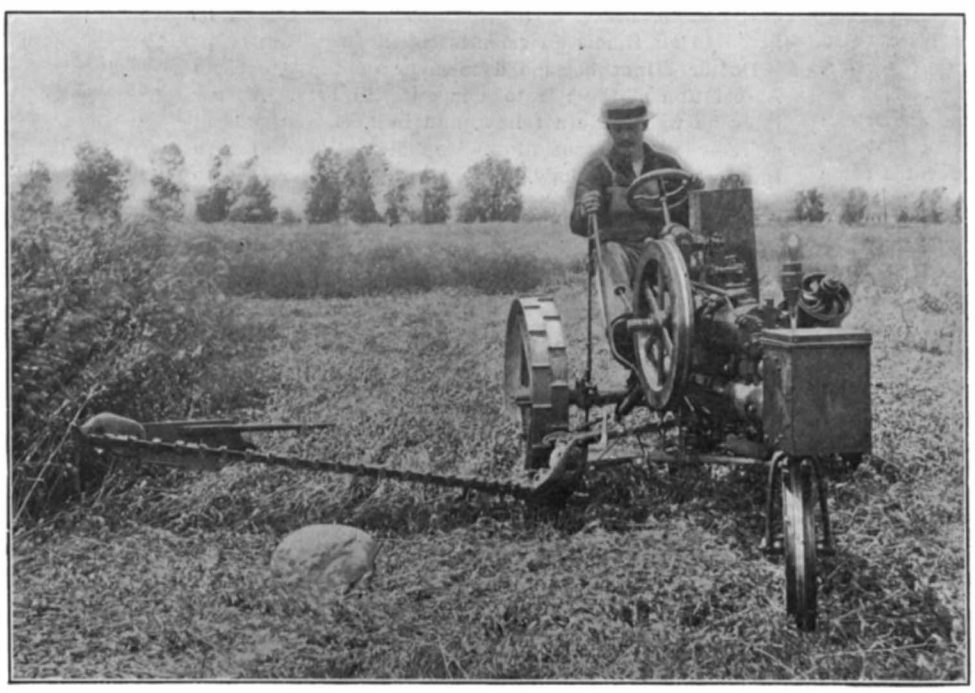


NEW CANTILEVER BRIDGE OVER WHITE PASS CANON, WHITE PASS AND YUKON RAILWAY.

## AN AUTOMOBILE MOWER.

The automobile is destined to become a great power in agriculture. It is true that for many years we have had various machines propelled by steam, as traction engines, steam thrashers, etc., but they can hardly be termed automobiles. Realizing that the time was coming when, even in agriculture, horses would be dispensed with to some extent, the Deering Harvester Company, of Chicago, Ill., began experimenting as far back as 1894, in order to devise means of driving harvesting machines by motors. They succeeded so well in their experiments that an automobile mowing machine was placed on exhibition in the American Agricultural Annex of the Paris Exposition last year, where it formed one of the most interesting exhibits. The duplicate of this machine, so far as all practical purposes are concerned, was tested in France in competition with other machines, and was found to work perfectly, running at any speed and turning corners more easily than a team of horses.

THE DEERING AUTOMOBILE MOWER.



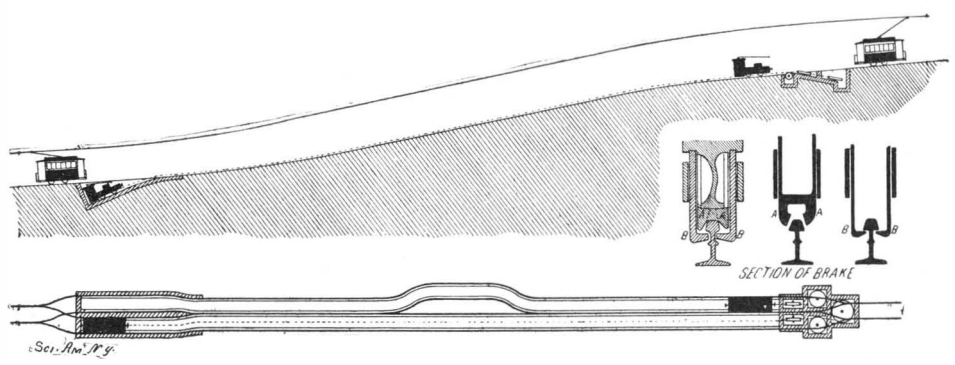
THE DEERING AUTOMOBILE MOWING MACHINE IN USE.

The type of harvester used is known as the "Ideal" mower, made by the company, being equipped with ball and roller bearings and being propelled by a gasoline motor. The motor consists of a pair of four-cycle gasoline engines of 6 horse power, mounted tandem on a large pipe 6 inches in diameter and 5 feet long. The rear of this pipe is adapted to be secured to the mower frame the same as an ordinary draft tongue, and the front end is supported by a steering wheel. The large pipe serves not only as a bed for the motor, but also as a reservoir, in the middle part, for the gasoline, and as exhaust chambers at its front and rear ends, one chamber for each cylinder, respectively. The crank-shaft is located between the two cylinders, the cranks being placed at an angle of 180 deg., so that the shock of explosion and the consequent jar are almost imperceptible. The gasoline passes to needle valves in the carbureter, where it is mixed in the usual way and drawn into the cylinders. The explosive mixture is ignited by means of an electric spark, a storage battery in this instance furnishing the necessary current. Each cylinder is water-jacketed and supplied with water from a tank having ample cooling surface, which is situated upon the main gearing frame of the mower. On one end of the crank-shaft is a bevel-gear meshing with a pair of bevel gears on opposite sides, which run loosely on a diagonal shaft. This diagonal shaft is geared with the crank-shaft of the mower, which drives the cutting apparatus and also the road wheels. On one end of the diagonal shaft and secured to it is a pair of friction cones adapted to engage at the will of the operator either one of the oppositely rotating bevel gears thereon. A single controlling lever within reach of the operator is connected with the friction cones and also with the steering wheel. By rocking the controlling lever on its pivot the friction cones are caused to engage either one or the other of the bevel gears and thus run the machine either forward or backward, or by disengaging both to remain stationary. On the end of this controlling lever is a hand-wheel, which is so connected to the steering wheel that the machine may be guided. Although the driving devices are designed primarily for a mowing machine, it is adapted to a variety of purposes. By simply disengaging the cutting apparatus it may be used as a portable agricultural engine for drawing loads about the farm, grinding feed, pumping water, sawing wood, or any other purpose for which an engine is valuable. There is hardly a country in the world where gasoline cannot be obtained, and we trust that there will be a great future for machines of the type illustrated.

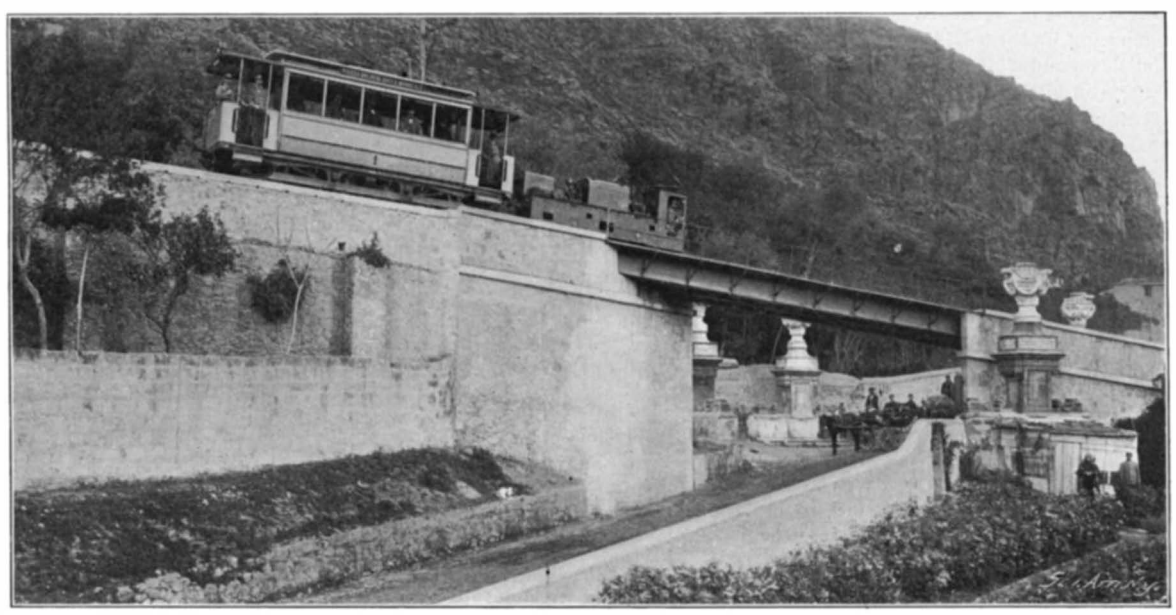
Recent experiments made to determine the loss ensuing by exposing coal to the weather, unprotected in any way, show, contrary to general belief, that it is very small. There was a gain in the amount of oxygen but a loss of carbon, hydrogen and nitrogen; the loss of calorific power was slight.

## PALERMO-MONREALE ELECTRIC INCLINE.

The new electric tramway system of Palermo has recently been completed by an inclined road of novel character, which connects the suburbs with the town of Monreale, situated on one of the high hills surrounding the city. For a long time a good system of communication had been needed, especially as the Cathedral of Monreale, the most important specimen of mediæval architecture in Sicily, attracts a great many foreigners. The Sicilian Traction Company, which controls the electric lines of Palermo, obtained the concession for an inclined road, which should mount from Rocca, at the foot of the hill, to Monreale, and thus connect it with the city system. This line commenced operation in February, 1900. Including the incline proper it is about 1.3 miles long and its upper end is 710 feet above the sea level. Although the line is not a long one, it merits description on account of its novel system of traction; this has been designed by the Continental Company, of Nuremberg, for the mechanical, and the Schuckert Company for the electrical part. The problem to be solved was to bring the ordinary cars of the Palermo electric road up to Monreale without giving them additional motive power or providing them with special brakes or organs necessary for the inclined railway. This has been accomplished by using a small electric locomotive which carries an auxiliary motor to aid on the incline, as well as the powerful brakes which are needed. The line, exclusive of 1,600 feet passing through Monreale, is divided into three parts. The incline proper is 3,300 feet long and has an 11 to 12 per cent grade; this portion is double track, using a common middle rail, except in the center, where two separate tracks are needed to allow the cars to pass. The end sections, above and below, are 2,360 and 627 feet long respectively, with grades varying from 4 to 8 per cent, and are single track.




PLAN AND PROFILE OF THE PALERMO-MONREALE RAILWAY AND SECTION OF BRAKES.

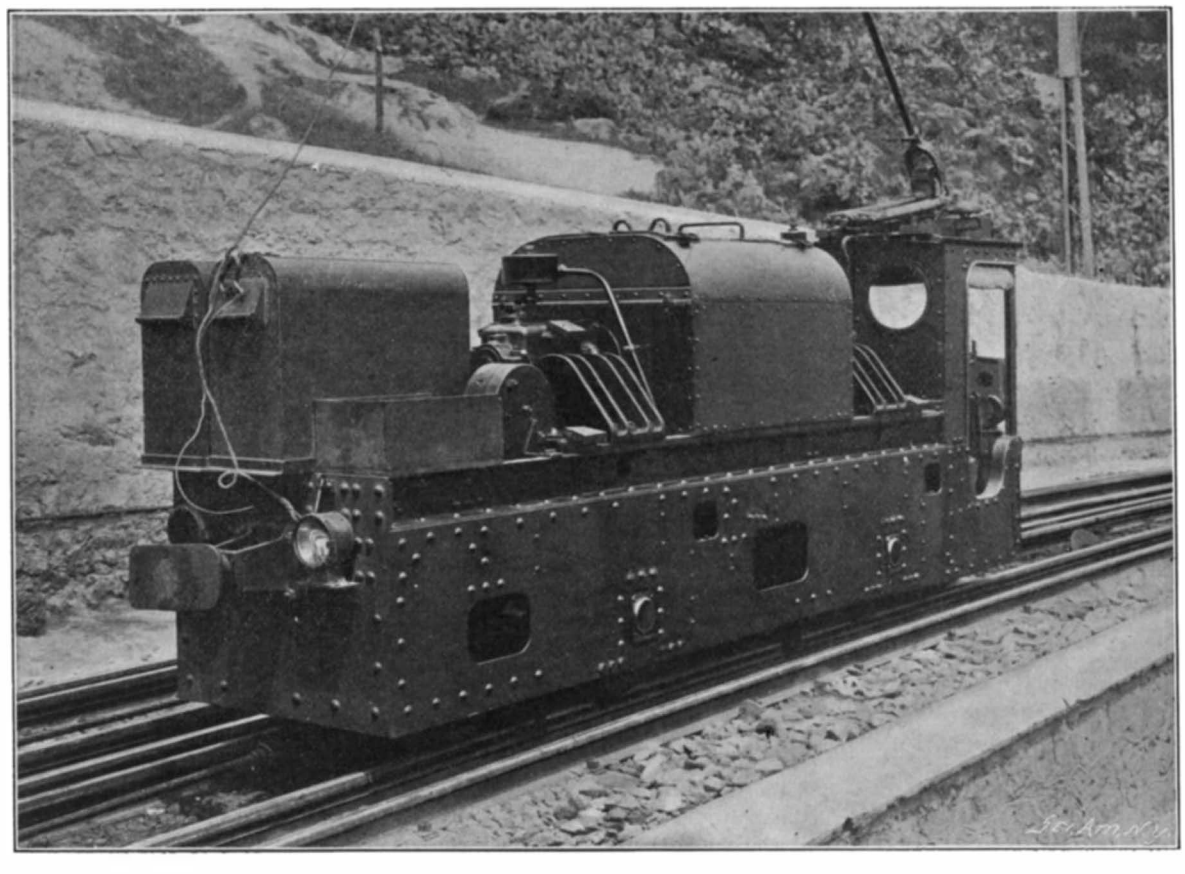


THE ELECTRIC FUNICULAR TRAMWAY AT PALERMO, SICILY.

On account of the steep grade of the middle section, the simple adherence of the car is not sufficient, at least in wet weather, and it has been necessary to adopt the present system of auxiliary locomotives. By this arrangement the two cars, one mounting and the other descending, cease to be independent when they come upon the inclined section, and each is coupled to a locomotive. The locomotives form a fixed system, being united by a cable which passes over a system of pulleys at the top of the incline; like the cars, they are provided with a trolley. It is, however, the downward-going train which supplies the power for the system. The present arrangement has a great advantage over the usual rack-and-pinion system in that it needs much less power to operate it, the weight of the descending train being utilized. The locomotives have two mechanical brakes, one of which is operated by hand and the other automatically, coming into action if the tension of the rope should fail. The locomotives are placed at the lower side of the car in each case, and the coupling for the mount and descent is carried out by a simple maneuver. At the lower end of the line the track of the locomotive, which is laid between the rails of the main track, runs down a short and steep grade into a pit, and the locomotive is then below the car level. The car coming from Palermo thus passes over it and stops at a few yards' distance. At the same time the other car at the top, coming down from Monreale, approaches the second locomotive and is coupled to it. This train then descends for a few yards until the first locomotive is drawn out of the pit by the cable and joins the car which is waiting above it. The system is then ready to operate, and the motors of the upper train are thrown on; this descends, causing the ascent of the lower train. When train No. 1 has arrived at the upper end, the car leaves the locomotive and proceeds by its own motors to Monreale, while the latter remains in place, ready to take back the same car or a second one. At the same time the descending train has arrived at the lower station, and here the car stops for a moment to allow the locomotive to run down into the pit; it then passes over it and proceeds to Palermo. The rope connecting the two locomotives passes over a large pulley, 10 feet in diameter, placed horizontally in a pit at the top of the incline, and is thence guided by two horizontal and two vertical pulleys until it descends the track; it is supported along the incline by the usual system of small pulleys between the rails. The most interesting feature of the system is the locomotive, or *carro-freno*, as it is called. The photograph shows its main features. It is designed, not to supply a large motive power, but especially to carry the powerful brakes which are indispensable to an inclined system. It carries in the middle a four-pole motor of the Schuckert type, and at one end is the motorman's cab, having on the roof the trolley and containing the controller and brake wheel. The rear box contains the resistance coils of the controller. The motor operates the wheels by a system of worm and ordinary gearing. The brakes, of the Esslingen type, act upon the head of the rail. One of these will be seen below each wheel and also in the sectional view on a larger scale. Their action is quite simple and effective. The brake is composed of an upper part, which comes down upon the rail-head, and a lower part, which comes up and grasps it on the lower side. A strong braking action is thus secured, and at the same time the vehicle is prevented from lifting. The two parts of the brake are brought together by turning a horizontal shaft to which they are connected by levers. In the case of the forward brake, this shaft is operated by a rod which passes to the conductor's handwheel. The rear brake is of the same pattern, but is made automatic in its action. To the shaft is attached a lever having at the end a heavy counterweight (seen in the rear); this lever is held in the off-position by the tension of the main cable, to which it is connected, but should the tension cease the weight descends and throws on the brake. The main dimensions of the locomotive are: Total length, 15 feet, or, with the buffers, 16 feet 8 inches; diameter of wheels, 28 inches; distance between axles, 5 feet 4 inches.

For the road-bed it has not been necessary to use iron construction work, except in the short bridge over the main road. The rails of the inclined system are of the Vignolles (railroad) type, but somewhat higher than usual. Those of the main track are 4.5 inches high, and those of the locomotive track 5.2 inches; they are laid upon metallic ties. The main track is 1 meter (39.4 inches) gage, and the smaller, 23.2 inches. The distribution of current to the line presents no difference from the usual trolley system, except that the poles, which are of iron trellis-work, are placed at shorter intervals than usual along the incline.

The electric cars of the Palermo system have two Schuckert motors and weigh about 8 tons. The current is supplied from the large station which has been recently erected for the lighting and traction of the city.



ELECTRIC LOCOMOTIVE, PALERMO RAILWAY.

### Immense Photographic Plate.

The largest photographic plate ever manufactured is being made by a dry plate company of St. Louis. It is 8 feet long, 4 feet and 8 inches wide and three-eighths of an inch in thickness, says the New York Tribune. It will be used by George Lawrence, of Chicago, who will make a photograph from a balloon of St. Paul and Minneapolis as the "Twin Cities." To make this plate it was necessary for the company to procure new apparatus of enlarged dimensions. A great marble slab, larger than the plate, was the first requisite. Upon this the plate is resting while the coating is being applied. Large chunks of ice beneath it keep it at a temperature that will cool the emulsion rapidly as it is applied. The remainder of the process of manufacture is identical with that

to which smaller plates are subjected. Two of the big plates will be made, so that a good one may be insured. This precaution is necessary, because the manufacture of plates in summer is much more difficult and uncertain than in winter, owing to the heat.

## THE HEAVENS IN SEPTEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

Though the eastern sky is now occupied by one of the dullest regions of the celestial sphere, the long line of constellations which gem the mighty arch of the Milky Way add distinction to the September evenings. Lowest among these, in the southwest, is Sagittarius, which at our customary hour of 9 P. M. is rapidly following Scorpio out of sight, carrying Jupiter and Saturn with it. Ascending along the brightest part of the Milky Way, we reach Aquila, and beyond, directly overhead, we behold Cygnus, in whose familiar outlines our imagination may trace the form of the Flying Swan, its outstretched wings extending far across the Galaxy. Lyra lies just to the west, and Delphinus is nearby to the southward.

Descending the stream of light toward the north, we reach Cepheus, and then Cassiopeia, and, finally, low in the northeast, welcome once more our old friends Perseus and Auriga.

The strange new star which appeared so unexpectedly in the former constellation last February has by this time lost so much of its brightness that it is barely visible to a keen eye on a dark night, and sends us only 1-300th part as much light as it did at first. The cause of this phenomenon, as in the earlier cases of the same sort, remains still shrouded in mystery. We know that some terrific convulsion of nature, on a scale almost too vast for human comprehension, has taken place, and has been accompanied by an evolution of light and heat sufficient to melt the solid earth like wax before a furnace; but that this has occurred at a distance so enormous that all may have been over a century before its swift messenger, light, reached us with the news. But just what happened, whether a collision of two stars, or of a star and a nebula, or some sort of explosion of a single star, astronomers do not yet know.

Turning from this at present intractable problem, we are reminded of a recent advance of knowledge by the sight of the bright Capella, rising in the northeast. It has been known for some time that the lines in this star's spectrum appear double at regular intervals, and it was consequently deduced that it consists of two luminous bodies, revolving about one another once every 104 days. These two bodies have actually been seen separately with the great telescope of the Greenwich Observatory, and have been followed through more than a whole revolution by the observations of last autumn and winter. These observations, which agree remarkably well with the previous spectroscopic results, show that the orbit is nearly circular and a little larger than the Earth's, that its plane is inclined about 60 deg. to the line of sight, and that the combined mass of the two stars is about 17 times that of the Sun.

They also confirm completely the results of the previous parallax observations, showing that the distance of the system is about two and a half million times that of the Sun, so that its light takes over 40 years to reach us, and that the two stars together give out about 140 times as much light as the Sun.

The most remarkable feature of the discovery is the extreme shortness of the period. The shortest double-star period previously known is over 11 years —about 40 times that of Capella. This statement refers only to stars which can be seen separately with the telescope. Those whose duplicity is known solely by spectroscopic methods vary in period from 2 days to 2 years, but Capella is the only one of them whose components are far enough apart to be separated by even the most powerful telescopes. Even so, they seem no farther apart than two candles an inch apart, on a mountain-top 40 miles away, would appear with the same telescopic power. How delicate the necessary observations are in such a case may be easily imagined.

The remaining constellations need little description. Ophiuchus and Serpeus fill the southwestern sky. Hercules and Boötes are a little north of west, and Draco and Ursa Major lie nearer the pole. Pegasus and Andromeda border the Milky Way on the east. Below them Capricornus, Aquarius and Pisces occupy a barren region. Aries has just risen, and Cetus is rising. A solitary bright star, Fomalhaut, in the Southern Fish, is the only conspicuous object in the southeast.

All the planets which are visible to the unaided eye adorn the evening skies at present. Mercury is evening star in Leo and Virgo. During the earlier part of the month he is too near the Sun to be seen—except telescopically in the daytime—but before October 1 he becomes visible low in the west just after sunset, though he is too far south to be well seen.

Venus is evening star in Virgo and Libra, setting more than an hour after the Sun. She is much brighter than Jupiter, and would be more conspicuous were she not so far south.

Mars is evening star in Libra and Scorpio. He is more than twice as far away as the Sun, and is correspondingly faint.

Jupiter and Saturn are evening stars in Sagittarius. The former is moving eastward among the stars, with steadily increasing speed, while the latter moves westward till the 14th, when he turns eastward, but moves slower than Jupiter, who is overtaking him.

Uranus is evening star in Scorpio, and is just visible to the naked eye. On the 5th he is in quadrature with the Sun—that is, he is 90 deg. east of him, and comes to the meridian at 6 P. M. Jupiter comes to a similar aspect on the 27th.

Neptune is morning star in Gemini. He is in quadrature on the 24th, but is west of the Sun, so that he is due south at 6 A. M.

While Jupiter is still favorably placed, it may be of interest to note that he is bright enough to cast a distinct shadow. It is true that nothing of the kind can be discerned outdoors, even on the clearest night; but the reason of this is not that Jupiter is too faint, but that the diffused starlight from the rest of the sky is too bright, so that shadows cast by the planet disappear, just as those cast by the moon vanish in twilight.

In order to see these shadows, therefore, we must cut out the diffused light of the sky. One of the easiest ways of doing so is as follows: Choose a window from which Jupiter is visible, while as little light as possible enters from nearby sources, such as street lamps. Close the shutters, but open the slats, so that the planet can be seen between them. The room should, of course, be otherwise perfectly dark. Then hold a large sheet of paper, or any other white object, in the path of the planet's rays, at a distance of several feet from the window. The shadow of the shutter, cast on this paper, will be distinctly visible. It may be well to add the caution that the observer should first remain for some minutes in the dark room to allow his eyes to recover from the glare of ordinary light.

With Venus at her best, the experiment is much easier, as she gives eight or ten times as much light as Jupiter.

Last quarter occurs on the morning of the 5th, new Moon on the afternoon of the 12th, first quarter on the evening of the 20th, and full Moon on the night of the 27th. The Moon is nearest us on the 1st, most remote on the 17th, and at her nearest again on the 29th. She passes Neptune on the afternoon of the 6th, Mercury on the night of the 13th, Venus on that of the 15th, Mars on the 16th (when an occultation is visible early in the evening throughout the southwestern part of the United States), Uranus on the afternoon of the 19th, and Jupiter on the morning and Saturn on the evening of the 21st.

### Causes of White Hair.

Mr. R. Lydekker in an interesting article on Arctic Animals, in Knowledge, discusses, among other things, the experiment of Sir John Ross on an Arctic lemming: "In this instance the little animal was kept in a comparatively warm room till winter was well advanced, when it was suddenly exposed to a temperature of 30 deg. below zero; a continued exposure to this and a still more intense degree of cold eventually resulting in its death, which took place within three weeks of the commencement of the experiment. In consequence of the conditions under which it had been kept, this lemming was still brown in midwinter, when it ought to have been white. As a result of its first night's exposure, the fur on the cheeks and a patch on each shoulder became completely white, and by the end of the first week the whole coat had turned white. On examination, it was found that only the tips of some of the hairs had become blanched, and that these white-tipped hairs were longer than the rest of the coat, apparently owing to a sudden growth on their part in the course of the experiment. By clipping these long white tipped hairs the animal was restored to its original brown condition. . . . In spite of the very obvious fact that these changes occurred under extremely abnormal circumstances, it has been argued that Arctic mammals which turn white in winter do so normally by a similar blanching of the hair of the summer coat, and that the greater length of the winter, as compared with the summer dress of such white animals, is due to a lengthening of the individual hairs of the former. Moreover, it has been inferred that the color-change is directly under the control of the animals themselves. Quite apart from any other considerations, one weak point in this argument is that the hairs in the subject of the experiment were white only at their tips. It was doubtless assumed that had the experiment been continued over a longer period, the white would have gradually extended downward till the whole hair became blanched. But had this been the normal way in which the change from a dark to a white coat is brought about, it is obvious that animals ought frequently to be captured in which the coat is in the same condition as that of the lemming. So far, however, as I am aware, no such condition has ever been described."

### Automobile News.

The London Fire Brigade proposes to emulate the example of the Paris Fire Brigade by the employment of motor fire engines, since it is anticipated that by this means the time in reaching fires will be considerably shortened and less space will be occupied during transit of the engines through the narrow streets. It is proposed to build the engine in the fire department's own workshops, since this will be much cheaper than if the engine were built by a private firm.

In Corsica a series of experiments is being made with an automobile system, which, if successful, will no doubt be put in service over many of the principal routes. The Société Française d'Automobiles is taking active steps in this direction, and has already sent two machines to Ajaccio which will be tried over the roads in the vicinity. These machines are an omnibus and a freight-wagon. It is proposed to shortly establish a regular service over two routes from Ajaccio to Bonifacio and to Vico, as well as from Bastia to Morsiglia.

The new electric fire pump, which contains 100 gallons of water and is ready to start for a fire at any moment, is proving quite a success at Paris. It has an electric outfit on the Bouquet, Garcin & Schivre system, with the necessary storage batteries. The report of the colonel of the firemen's regiments points out an instance where the new fire pump rendered an important service. Owing to the fact that it arrived quickly at the fire with its water reservoir and its pumps all ready to act, it was the means of preventing the explosion of a cellar full of chemical products. The report states that the horse fire engine would have arrived too late, and that the hose could not have been coupled to the nearest fire plug in time to prevent the explosion.

Owing to the failure of the Pan-American authorities to secure the necessary consent for the proposed 100-mile road race from Buffalo to Erie in September, 1901, the Automobile Club of America regrets to announce that its annual sweepstakes race and one-mile record race will not be run over this course. Although the consent has been absolutely promised for some time, it has not been received, and failing such consent no definite action could be taken by the club. The time is now entirely too short in which to receive entries and successfully organize a race of such an international character as this race was intended to be. The governors of the club have therefore decided to endeavor to hold the annual sweepstakes race and mile record race elsewhere in the month of October, preserving its international character by inviting entries from abroad as originally proposed. Believing that without these two races it would be impossible to organize a successful "Week of Sports" in Buffalo, the governors have recommended that the same be abandoned.

### Return of Encke's Comet.

Encke's periodic comet has returned and was well seen at this, the Mount Lowe Observatory, at 3 h. 45 m. this morning, August 14, 1901. It was then in altitude 6 h. 58 m., and in north declination 30 degrees 34 minutes, with rapid motion toward the southeast. This comet was discovered in 1805, and has awakened great interest among astronomers owing to a diminution of its periodic time. Thus in 1805 it made its circuit in 1,212 d. 12 h.; in 1829, 1,211 d. 10 h. 34 m.; in 1858, 1,210 d. 13 h. 41 m.. This was thought to be on account of the resistance of a thin medium in space. But other comets were not retarded, and since 1868 the retardation of Encke's comet is diminishing—so the existence of the rare matter in interstellar space is not demonstrated. The comet when seen here rising over the peak of a high mountain was quite white, faint, diffuse, and large, with but slight indication of a nucleus. Its time of revolution is the shortest known.

EDGAR L. LARKIN, Director.

Mount Lowe Observatory, Cal., August 14, 1901.

### Award of the Nobel Prizes.

Two of the Nobel prizes have been awarded after mature deliberation. Dr. Niels Finsen, of Copenhagen, received one for his discovery of the light treatment for lupus, and the other one was given to Prof. Pavloff, the Russian physicist, for his researches in metabolism. In each case the honor was well deserved.

One factory in Ohio turns out a hundred million finished matches each twenty-four hours. Fifty million feet of lumber is used annually in the United States in the manufacture of matches, a industry which gives employment to some fifteen thousand people.

### Science Notes.

French painters are greatly agitated over the subject of white lead and white-lead poisoning. The painters of Grenoble recently went on a strike to demand that all employers should use zinc white instead of lead white.

P. Carmody presents in The Journal of Tropical Medicine the sketch of a mosquito net designed for the use of travelers in the tropics. It is either attached or attachable to the ordinary linen umbrella that forms a part of every tropical outfit, and the combination affords protection from the sun during the day and from mosquitoes during the night.

Dr. Carl Peters has returned to London after an extended journey from the Zambesi to the Sabi Rivers, and has brought home news of interesting archæological discoveries on the frontier of Mashonaland, says Nature. One of these is a small figure of Egyptian workmanship, which is believed to date back to 2,500 years before the Christian era. There have also been found thirty-three copper and six silver coins and a couple of stones bearing inscriptions. It is hoped that a scientific expedition will be sent out to make further investigations.

The Grand Trunk Railway, of Canada, has recently constructed and put in service a car specially adapted for the distribution of live fish to waters along its lines, says the Railway and Engineering Review. This car was built in the shops of the company at Point St. Charles, the requirements for the service being compartments for carrying fish in which an even temperature can be maintained; proper circulation of water and air in the tanks containing the fish may be had and sleeping and living accommodations provided for the attendants. The interior of the car is arranged with a series of galvanized iron tanks to hold from 1,000 to 1,500 fish. At one end of the car is an upper and lower berth, like those in a Pullman car, to accommodate two men. Ice for keeping the water at a certain temperature is carried in two compartments built for this purpose and holding about one ton each. Arrangements have been made for replenishing the water in the tanks, en route, which is done by attaching a hose to any of the hydrants at stations on the road.

The following details from the Fireman's Herald show the extraordinary precautions taken to guard Independence Hall, Philadelphia, from destruction by fire. Watchmen maintain a patrol every hour of the day and night, and the only lights permitted in the old building are those used to illuminate the clock at night. For the boilers used to heat the building fireproof vaults have been provided under the archways, and only two electric wires are allowed. Chief Baxter has provided for the appearance of six engines, two trucks and a chemical engine within two minutes after an alarm is sent in from the fire alarm box in the square. There are standing instructions that, if fire should gain headway in the structure, a general alarm shall be sent in, calling to the scene twenty-six fire engines, six trucks, and another chemical engine, as well as the chief and nine district engineers. Every wire in the vicinity of the hall is specially insulated, and officers of the fire department regularly join the watchmen in inspecting the edifice. Portable fire extinguishers are scattered about the building, and directions for saving the famous old portraits that hang on the walls are conspicuously posted. There is a peremptory order displayed that reads: "In case of fire get the Liberty Bell out of danger at any cost."

Visitors to Bologna are generally puzzled by the two towers, the Asinelli and the Garisenda. If judged impartially they are not better examples of brickwork than can be seen by the thousand in the factories of Lancashire. They have suffered from settlements, and have long ceased to possess verticality. The Garisenda especially is so much out of plumb one wonders why it has not collapsed. But Italy exercises so much glamor over the judgment that we may occasionally hear travelers speak of the towers as if they were the most picturesque constructions which have an important function in general views of the city. The Garisenda has, however, literary interest, for Dante refers to it in his Inferno, comparing the giant who stoops to seize him and Virgil to the tower at a time when it was cloud-capped. The inclination of the Garisenda is due to a sudden sinking of the soil, but it has stood so well there must be some pity for it, for as far as can be judged it can hardly escape from a collapse. The soil which so long was unaffected by earth movements is now sinking, and produces cracks in the walls of the structure, which is square in plan and about 180 feet in height. The mortar is falling out of the joints. It is perhaps excusable, says The Architect, for the authorities of the old scholarly city, which was known as the Alma Mater Studiorum, to imagine that the tower cannot be overthrown, and to assume that its security can be insured by the application of a little rough-cast; but a structure that is 10 feet out of the perpendicular, and is nearly a thousand years old, demands a more efficacious remedy.

### Engineering Notes.

Foreign naval powers seem to be demanding much lower speeds from torpedo boats than were specified a few years ago. Numbers of these little vessels have been built recently which are required to run at only 25 and 26 knots.

The efficiency of oil-engines (that is, engines in which the impulse is derived from the explosion of oil-gas and air) is increasing daily. Not only is the regulation greatly improved, but the consumption of oil is decreasing; also, the size of the engines is increasing, so that they are now formidable rivals of the steam engine, especially in portable work. The advantages resulting from doing away with a boiler, and its indispensable water and fuel supply, are very great, giving the oil-engine an advantage which will be very hard to overcome.

Another test of the respective merits of English and American locomotives on a railroad in Jamaica has resulted in a great victory for the American engine, which drew 126 tons over the heaviest part of the line in seven minutes under the schedule time. The English locomotive completely failed to pull the same load, and, when materially lightened, failed to make even regular time. English experts and the local railroad officials were present at the test, which was a great disappointment to the Englishmen. Having in mind the relative cost of the locomotives, the government here is expected to make strong representations to the crown agents in London who arranged the purchase of English engines.

An engine for passenger service has been tested for two years last past and is claimed to be an advance upon existing locomotives. It is a three-cylinder compound, one high-pressure and two low-pressure cylinders, the latter being outside-connected, while the former works on a cranked main axle. The high-pressure cylinder exhausts into both the low-pressure cylinders, and provision is made for admitting live steam into the low-pressure cylinders on starting a heavy train. These last are 20-inch diameter by 24-inch stroke, while the high pressure is 19 inches by 26 inches stroke. A new feature in the boiler is the employment of water-tubes in the upper part of the firebox, crossing it from side to side; these tubes increase the heating surface in the fire-box some 30 per cent, and the outer ends deliver into the water space, the opening in the shell sheet, externally, being protected by a bonnet and bolts in the usual way. It is stated that this engine has done good work for its dimensions, taking trains of 404 tons at a speed of 50 miles per hour over heavy grades.

In a certain new type of American water-tube boiler the steam system is in the form of a truncated cone, the dome surmounting the tubes, which are expanded into a tube-sheet bolted to the dome-fiange; the dome is, therefore, only restrained from being blown off by the holding power of the tube-ends in the tube-sheet, the sheet itself being only three-eighths thick. The safety of this plan (there being no stays of any sort) has been questioned, but although subjected to severe strains, no evidence of distress or leakage has been shown. Experiments recently made abroad upon this method of fixing tubes, as regards safety, show that 1-inch tubes, ends projecting slightly beyond the tube-sheet, stood 3 tons before starting; tubes that were bell-mouthed stood 6 tons before starting. As there are from 100 to 500 tubes in each boiler, according to size, it will be seen that the factor of safety is very large; the load on a dome head 36-inch diameter at 400 pounds per square inch would be 406,800 pounds; the number of tubes being 150 there is only 2,070 pounds on each tube-end, barely one ton.

The most conflicting testimony is given as to the loss of evaporative power in steam boilers by the presence of scale on the heating surfaces generally. Evidence gathered by the experience of one party is flatly contradicted by others of equal ability, the only deduction possible being that sometimes scale is a hindrance to steam making while in other cases it is not. There can be no question, we think, that scale is certainly not a benefit under any circumstances, being simply matter in the wrong place, and from that aspect should not be allowed to accumulate; it is corrosive, for one thing, and prevents the physical condition of the plates from being seen. Locomotive engineers have testified that a boiler that was full of scale, and had to be taken to the shop to have it removed, steamed no better after than it did prior to cleaning. Mr. Barrus, of Boston, says that he knows of no experiments that settle the question definitely one way or the other. On the other hand, Prof. L. P. Breckinridge, of the Mechanical Engineering University of Illinois, tried an experiment with a locomotive on the Illinois Central Railway, and found that the loss of fuel due to scale of only 1-32 of an inch thick, to 3-64, was 9.5 per cent. A total weight of 485 pounds scale was removed from the boiler under test, so possibly the Professor was not far out of the way, but "who shall decide when doctors disagree?"

### Electrical Notes.

Experiments are to be tried with the wireless telegraph system between Boston and Danvers. A relay system for intercepting a wireless message and sending it forward is to be used.

Consul Warner, of Leipzig, notes that a recently patented insulating material is made by taking pulverized casein and mixing it with vegetable oils. The mixture, to which rubber, caoutchouc, resin, or coloring matter may be added, is pressed into forms and dried, or vulcanized by the addition of sulphur.

Consul-General Hughes, at Coburg, Germany, reports to the State Department that a French-Belgian syndicate is reported to be planning, under the patronage of the King of the Belgians, to build an electric express line for passengers and light freight between Paris and Brussels, and from the latter place to Antwerp. The trip from Paris to Brussels is expected to be made in one and a half hours, and from Brussels to Antwerp in ten minutes.

The "flame discharge" produced by Spottiswoode by means of an alternate-current consuming 5 horse power, and transformed to some 120,000 volts, shows some peculiar spectroscopic properties which have recently been studied by A. W. Wright and E. S. Downs (American Journal of Science). The discharge consists of a light nebulous flame of a whitish color, with a slight tinge of yellow or green, rising gradually from the horizontal terminals and meeting at the center, where the color changes to a reddish hue. Besides a number of lines extending from 6,127 to 6,269, photographed by means of plates stained with erythrosine, the authors observed some 60 lines comprised between wave lengths 3,063 and 3,134 in the ultra-violet. These lines are the same whether the electrodes are copper or platinum, and therefore they must belong to some gas or gaseous combination within the spark-gap. A jet of steam blown through the flame greatly enhances the brightness of the lines. The authors, however, consider that they are not solely due to water vapor, but rather to combinations of gases, such as oxides of nitrogen, facilitated by its presence.

The Western Electrician gives details of a new portable electric motor for propelling small boats. The novel feature about this new device is that the motor itself is under water, while the storage batteries are in such compact form that they may be placed under the seats of an ordinary rowboat. In addition to propelling the boat, the motor takes the place of the rudder, and serves to steer the craft as well. This propeller, as the combination of motor, propeller wheel, and rudder is called, is complete and portable, weighing about 35 pounds. Using two boxes of cells, the motor drives the boat forward or backward at the fairly moderate speed of four miles an hour, and it will run 20 to 30 miles on one charge. By the addition of more cells, however, it is possible to attain a speed of six miles an hour. One advantage which is claimed for having the motor outside the boat is that there is no strain or vibration, and on this account it is unnecessary to build a boat of any extra strength or weight in order to carry the power. It is further declared by the company owning the patents for the device that the construction is such that the motor works perfectly well when submerged in water.

Signals from the 30-inch searchlight on the electric tower of the Pan-American Exposition were sent to Niagara Falls, July 25, by Prof. Geo. F. Sever, Superintendent of Electrical Exhibits, in the presence of the electrical jury, thus demonstrating the feasibility of this method of signalling at night. Since that time searchlight signals have been sent from Buffalo to Toronto, a distance of 58 miles, through arrangements completed by Prof. Sever, in co-operation with Mr. William S. Aldrich, consulting electrical engineer, of Toronto. The first trial was made, 9:10 P. M., August 9, with clouds over Toronto. The local illumination of the overhead sky by the electric arc lights in the streets of Toronto effectually prevented any discrimination being made between the local and the Buffalo illumination of the clouds. The second trial was made 9:50 to 10:15 P. M., August 13, with a perfectly clear atmosphere. Owing to the smoke settling down over the city no signals could be discerned from the top of the Municipal Hall tower, Toronto. This was the prearranged objective point for both experiments. Special long-distance communication was arranged between the top of the tower and the Electrical Tower, at the Pan-American, through the courtesy of the Bell Telephone Company, of Ontario, represented by Mr. K. J. Dunstan, of Toronto. Every detail of the experiment could be followed. The special instructions were to depress the searchlight to the lake horizon, bearing on the Municipal Hall Tower, Toronto; then to sweep the horizon a definite angle, to the right and left of this bearing; and later to elevate and depress the light at the original bearing. All of these signals were very clearly discerned during the second trial by Mr. C. H. Rust, City Engineer, Toronto, with party located on Center Island, two miles off-shore from the city.

### LENGTHENING OF THE S. S. "IROQUOIS."

There has just been completed at the Erie Basin, New York, the largest job of cutting and lengthening a steamship ever undertaken in this country. The work was done at the yard of John N. Robins & Company, in the drydock adjoining that in which the Cup challenger was docked on her arrival in this country. The "Iroquois," a vessel of 2,944 tons, was cut clean in two, the forward half pulled 48 feet forward in the dock, and the gap filled in with frames and plating to match the old hull—the whole job being completed in the brief space of 21 days.

The "Iroquois" was built at the yard of William Cramp & Sons, Philadelphia, Pa., in 1888. Her dimensions are as follows: Length between perpendiculars, 280 feet; molded beam, 46 feet; molded depth, 28 feet 6 inches; tonnage, 2,944 tons. The hull is built of steel. The frames, which are spaced 2 feet apart, are 5 inches x 3 inches x 10.7 pounds; the reverse bars 3 inches x 3½ inches x 7.7 pounds; the stringers are 4 inches x 5 inches x 15 pounds, and the floor-plating 29 inches x 21½ pounds.

Her engine is a 3-cylinder triple-expansion, with cylinders 23 x 36 x 60 inches diameter and 36-inch stroke. It indicates about 2,000 horse power.

The "Iroquois" was put in dock in the usual way, the keel-blocks being 4 feet 6 inches high from floor of dock. It was decided to cut the hull between frames Nos. 63 and 64, the boiler bulkhead being at frame No. 68, or 8 feet aft of the point of cutting. The accompanying diagram, which has been prepared from drawings furnished by the John N. Robins Company, shows in detail the construction of the ways and cradle, and the rigging of the gear with which the vessel was pulled apart.

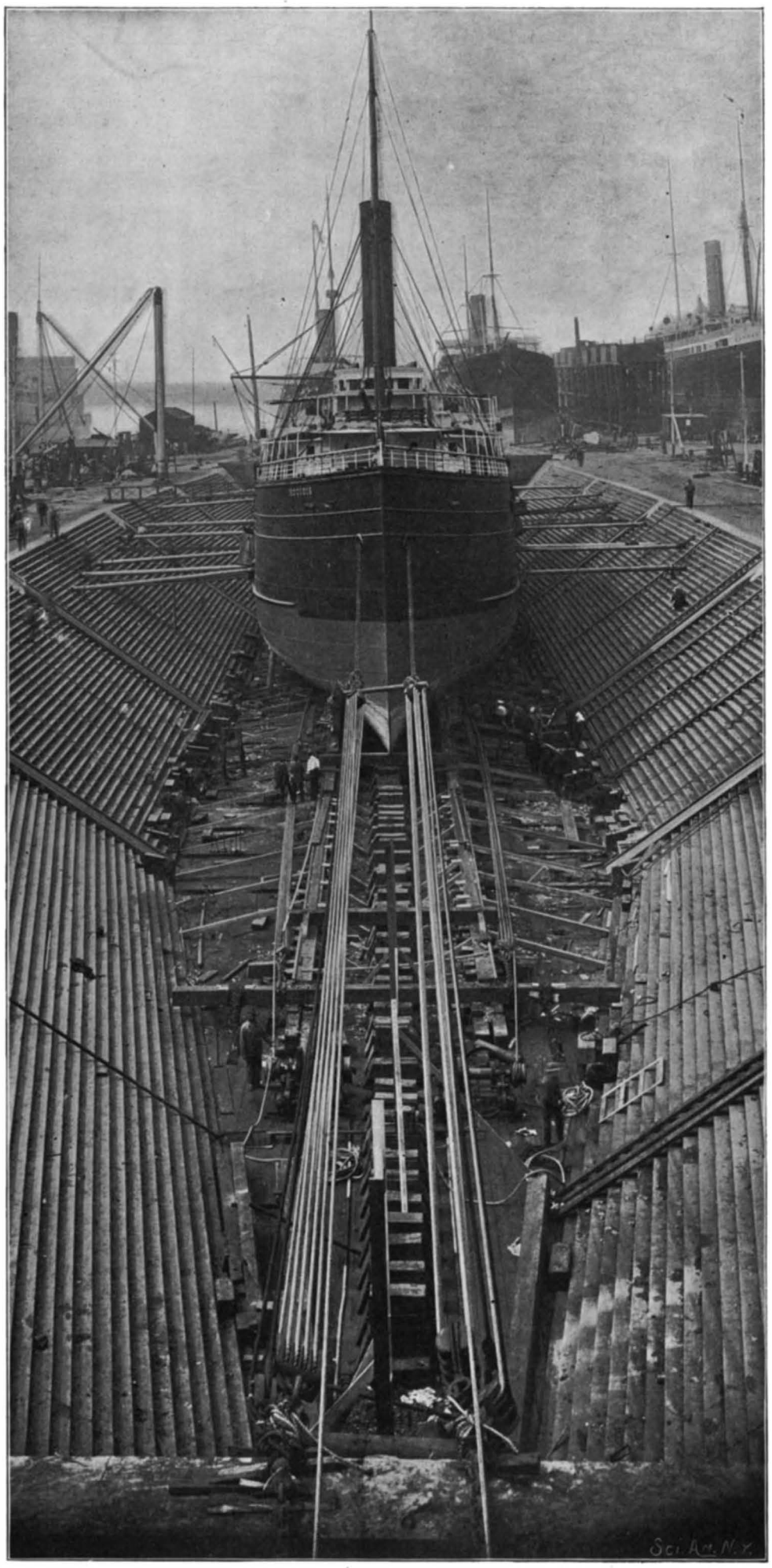
The fixed ways, which were 12 x 12-inch, 8 x 12-inch and 16 x 12-inch logs, were laid on 8 x 12-inch blocking on the floor of the dock, and well shored guide-pieces were spiked to the outside of these ways to keep them in place. The sliding ways were built of 14 x 10-inch timbers and tied together by 1¼-inch iron rods, spaced 8 feet apart, and also by 4 x 4-inch timbers. The groundways were 206 feet long and the slidingways 107 feet long. The rubbing surfaces of the ways were planed, smoothed and freely lubricated with a mixture of tallow and fish oil.

When everything was completed the wedges, which were put in between the cradle and the slidingways, and were spaced 15 inches apart, were gradually driven home until the weight had been lifted from the keel-blocks and was entirely carried by the ways. Across the slidingways in front of the cradle was put a 12 x 12-inch beam, rammed under the stem of ship, to prevent it from dropping when the keel-blocks were taken away. Also across the top of the groundways was put a beam 12 x 12 inches at an exact distance of 48 feet from the forward part of the slidingways, to act as a stopper.

The pulling apart of the vessel was accomplished by means of four 1½-inch stud chains and four pairs of 5-inch manilla ropes working in 8 and 6-fold blocks, respectively, at the top and bottom of the dock, and two pairs of double steam winches of the following dimensions: One with two cylinders 8 inches in diameter by 14-inch stroke and one with two cylinders 7 inches in diameter by 12-inch stroke; while at the bottom of the dock were two two-cylinder winches, one with cylinders 6 x 12 inches and the other with cylinders 6 x 10 inches.

One pair of chains was led through the hawse pipes and well secured within the vessel. One pair of 8-fold blocks was fastened to these chains, and the other inshore blocks were connected to another pair of 1½-inch chains, which were led through one of the dock buildings and secured to a 12 x 12-inch beam placed against the wall on two 12 x 12-inch logs placed vertically, and cemented with the lower end passing into the ground. The ropes from the blocks were led to the winches.

The chains at the bottom of the dock were connected to the ship by a ¾-inch thick x 18½-inch wide plate bolted onto the shell, and extending over a length of two frames. The forward end of the plate was locked to receive a shackle, to which the chain was fastened. The other end of the chains received a pair of 6-fold blocks. The forward blocks were fastened to a 12 x 12-inch beam, laid across the groundways below the sliding surface. The ropes from these blocks were led to winches located on the bottom of the dock.



VIEW OF "IROQUOIS" FROM HEAD OF DRYDOCK.

In cutting apart the hull, all that was necessary was to cut off the riveteads and knock out the rivets. This was done in every case at the original butts. The three decks and all woodwork were cut and sawn through, and everything was made ready for the pull. After 35 hours' work preparing for the pulling apart of the hull everything was ready at 12 o'clock on August 14.

At a given signal from Mr. W. D. Dickey, superintendent of the Drydock Company, who was standing at the bottom of the dock under the bow of the ship, the winches were started at full power, and at the same time two 100-ton pumps, which were placed at the cut, were worked to help the winches in starting the weight of 600 tons. The massive forward part of the hull began to move slowly and steadily forward, and the four winches working up to their full power proved to have an ample margin of power for moving the heavy load. The full movement of 48 feet was completed in the short time of 2 hours and 14 minutes.

When the two portions of the ship were lined up and exact measurements taken, it was found that an exact movement of 48 feet had been obtained at each side, in four different places, and that the stem was perfectly straight, so that no wedging or lifting was necessary.

Some time before and during the building of the ways the 24 frames, reverse-bars and floors for the new section of hull were made in the shops to model obtained from molds taken from the ship.

The work of carrying them into the dock and putting them in place was done by hand. It commenced on Thursday, the 15th, and at noontime on Saturday, the 17th, the new part was in frame. The framing and plating are similar to that of the rest of the hull, with an addition of doublers extending over two-thirds of the length of the new ship.

These doublers are put on the strakes next to the keel-plate, on bilge-strakes (these being 22¼-pound plates), on sheer-strake, and on garboard strake (these are 30-pound). Inside doublers are placed in the way of port-openings.

It is estimated that the additional buoyancy afforded by the new section will enable the ship to take 2,000 bales of cotton more in her hold at the same draught as before.

### A Few Points on Practical Boiler Testing.

The proper method of testing any boiler, land or marine, whether new or after a general repair, is, firstly, to heat the boiler up to a temperature of 180 deg. F., more or less, but not sufficiently to form steam pressure; this will serve to dissolve all the oil and grease from between the seams, about rivets, joints and other parts, and which has been used in construction or repairs. Now this oily matter, if the boiler were tested with cold water pressure first, would certainly ooze farther into the seams and joints, and undoubtedly cause a great number of leakages. The boiler for this heating should be filled nearly to the top.

After the boiler has received a good seasoning, as it were, and while it is still warm, the second process of cold water testing, or the resistance test, is applied. It should now be filled right up to the top, by allowing water to flow in through an ordinary large hose under gravity, and afterward it should be tested with the hydraulic testing pump, with pressure gage attached either to the feed check valve inlet or other convenient point, preferably on top. The amount of pressure applied during this test depends entirely upon circumstances, which are variable. A new boiler must be tested to resist pressure equal to at least twice the blowing-off pressure at the safety valves when under steam, and this pressure should be maintained steadily for about 20 minutes. When an old boiler is to be tested after repair and inspection, the greatest care must be taken, and the age, service, and condition of material will determine the degree of test required. No boiler, after a reasonable period of service, even though receiving a good general repair, must be considered "as good as new."

A safe pressure for a test on old boilers is one-tenth more than the blowing- off pressure at which the boiler

is intended to be used, and this pressure can only be determined by thorough inspection, etc. During this test the boilermaker will be able to locate leaks, etc., and by letting pressure off from pump they can be easily repaired and in a few minutes pressure re-applied. Always avoid, as much as possible, calking seams, etc., while the boiler contains a high pressure. At the conclusion of the water test, run off the water until the water gage columns are about two-thirds full; then put in fire and raise steam gradually for the last test; that is, to the blowing-off steam pressure. It is necessary here to state that the boiler pressure-gage must have been thoroughly examined and tested before beginning any boiler tests whatever, by comparing it with a standard steam testing gage or other standard testing machine. For this purpose a Crosby weighted gage tester is excellent and thoroughly reliable. If you are at a distance, or have not the convenience to do this, send your gage to any well-known firm and they will set it for you. But on no account work with a pressure gage of which you are doubtful; this sort of thing has often been the cause of the loss of many lives.

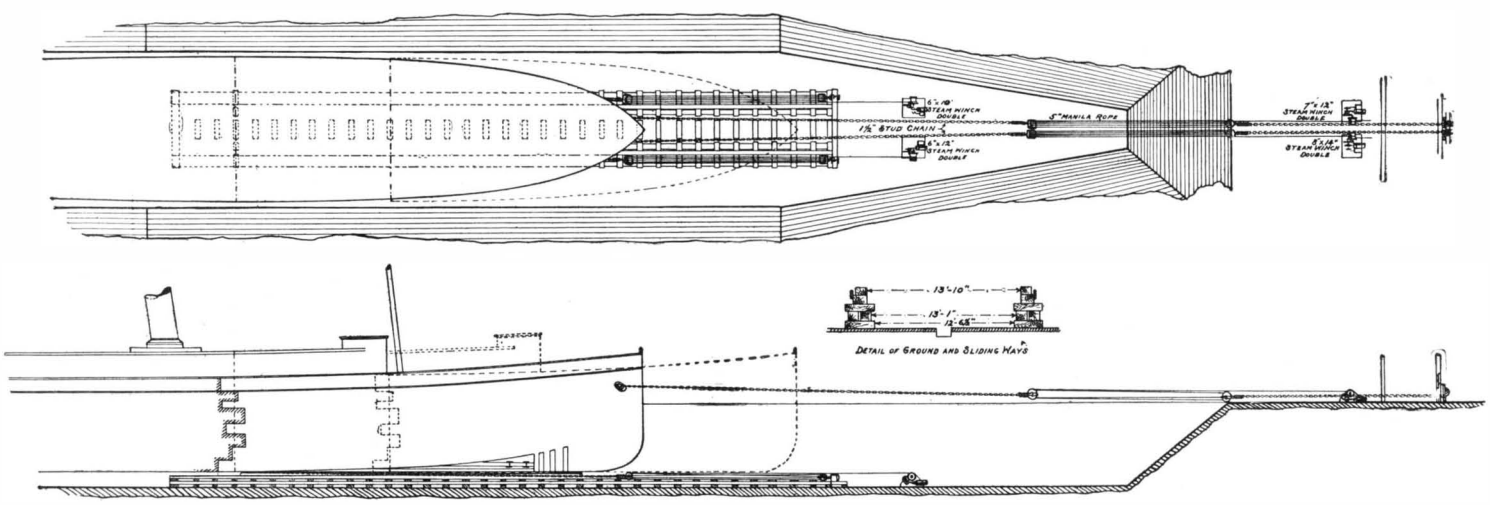



DIAGRAM SHOWING ARRANGEMENT OF WAYS AND PULLING GEAR.

Steam must be now raised to the intended blowing-off pressure, and when at this pressure steam must *blow* off with full force and not merely simmer through the safety valves.

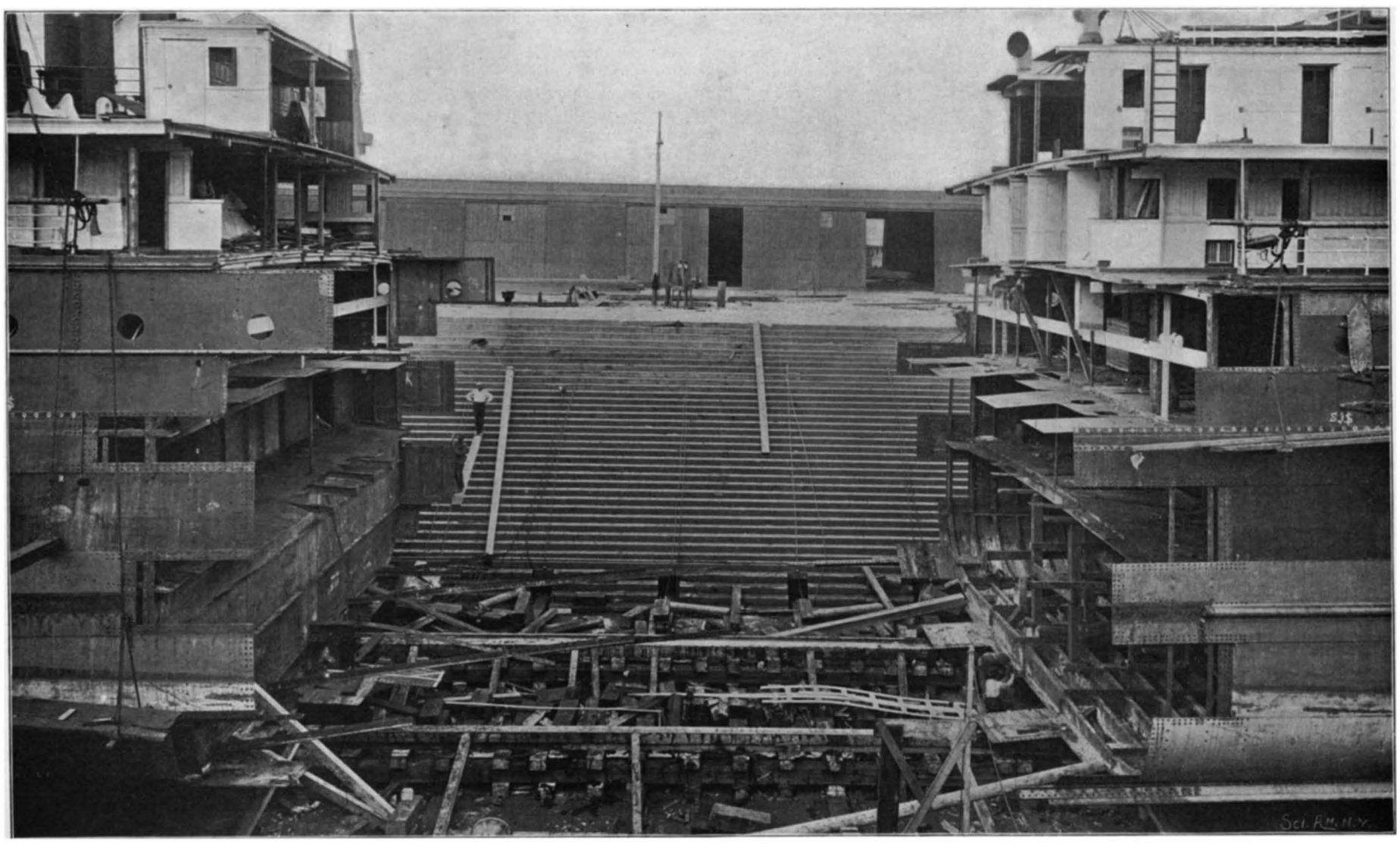
The safety valves are now set to blow off at the pressure intended, and are marked, or distances taken, so that when the boiler is cool the springs or weights may be secured by washers, rings or other means so as to prevent any additional pressure being put on them, and thus endangering the boiler and possibly causing an explosion. Advantage may be taken at this point to try injectors, pumps and other motive power connected to boiler.

In the examination of a boiler previous to repairs or testing, there are many means of determining, practically, the condition of the material; among these are scraping, chipping, sounding with a light hammer, heating flawed parts with a petrol lamp, drilling through plates at fire levels of tubes or flues and in combustion chambers and at any worn parts; cutting out a piece of the worst plate, and bend-testing the same; cutting out a few suspicious looking rivets, which generally show very plainly if bad; examining closely the sides of these rivet holes; also the plates round the orifices to which gun-metal attachments are fastened. Analysis of scale and also a close examination by picking those parts liable to external corrosion. In conclusion, one cannot impress too strongly upon all those whose occupation is boiler-management, the great care they ought as a sacred duty to observe when in charge, no matter whether the boiler is new or old. Remember, a boiler is like a chain; the weakest link is its strongest part.—John Wm. Fletcher, Head Foreman, Anglo-Chilian & Nitrate Railway, Focopilla, Chili.

A curious experiment was recently tried by Prof. Dixon, of Yale University, while on his vacation in Colorado. It has been contended that the sluggish circulation of reptiles would prevent any grafting of their bodies. A rattlesnake was extended with an iron hook circling his head, says the New York Times. An adder was obtained and cut in two. The rattlesnake was then treated in the same way. The tail of the adder was then sewed to the rattler with a strong thread, and after twenty-four hours the iron collar was removed and the composite reptile was placed in a cage where he gave every evidence of vitality. Although the rattle was absent from its new tail, the supply of virus to its fangs remained undiminished. It was allowed to strike a rabbit and the latter began to swell and was dead in an hour. The rattlesnake will be kept under scientific observation for several months.

### Palm Leaf Fiber.

The fiber of the palm leaf has lately been used for experiments in order to test its suitability for textile manufactures, and the following process is said to have given surprising results: The fiber is first boiled in water or alkaline solution, then allowed to ferment, and afterward dried and passed through heavy rollers, which separate the fibers from the pulpy mass. The fiber assumes a light or dark color, according to the length of the retting process, and is of great strength, useful for various industrial uses. Where no machinery can be employed, the extraction may be accomplished by the following chemical process: The stalks of the leaves are thoroughly dried, and allowed to undergo fermentation in a solution of caustic soda until the mass has reached the point where the fiber can be easily separated, after which it is kept in a water bath for 24 hours. Then it is treated with a mixture of cocoanut oil and colophonium in equal parts, and placed in a bath of sulphuric acid and water. Finally the material is thoroughly rinsed in clean water until the fiber is entirely separated and of a clear white appearance. Where cards are used, the leaves are carded as soon as gathered from the trees, with the help of mechanical means, to make them soft and easily workable, and then submitted to the same fermenting and pressing process.



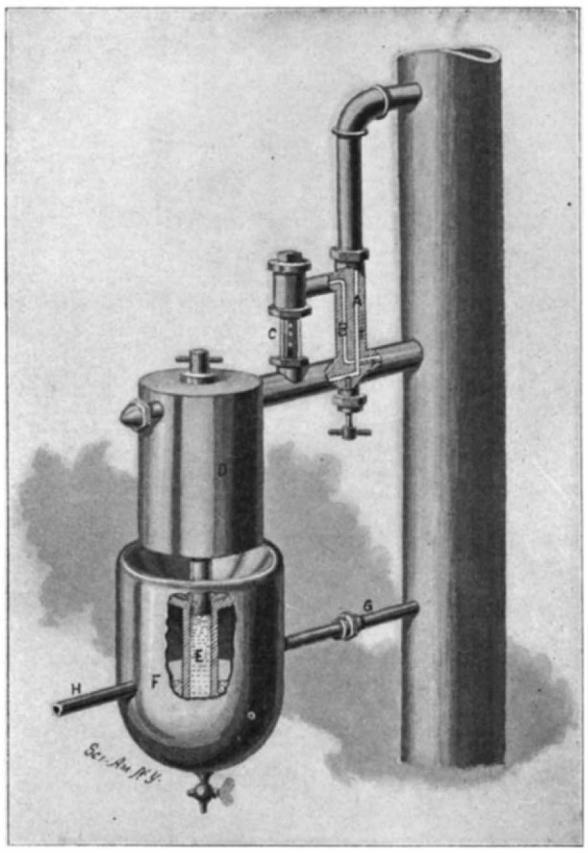
AFTER THE PULL; THE BOW DRAWN FORWARD 48 FEET.

The oil-bearing areas of the world seem to be increasing instead of diminishing in productiveness. Aside from the new territories being developed in Texas and California the Russian districts about Baku have increased their output more than 100 per cent in four years, and the objection to the use of fuel-oil, on account of its scarcity, seems hardly tenable at present. Experiments with oil-fuel are being constantly carried on, with results varying according to the ability of the experimenters to observe correctly, the latest report being that oil alone is insufficient; it must be reinforced with coal to obtain the best results.

### A NOVEL LUBRICATOR AND HEATER.

To provide a means for keeping the lubricant of steam-engine valves and pistons in a flowing condition during cold weather, Mr. Thomas Dixon, of McKeesport, Pa., has devised the simple heating device which is shown in our illustration.

Connected with a steam pipe are two circulating



AN IMPROVED LUBRICATOR

tubes joined by a glass sight tube, *C*, the usual circulating passages, *A* and *B*, being provided. The sight tube communicates with the oil cup, *D*, which is arranged above the heater, *F*. The heater has a concaved top somewhat larger in diameter than the oil cup. By reason of this construction air will be deflected by the hot concave top, so that there will be a hot air cushion between the oil cup and the heater.

A tube, *E*, extends down through the heater and communicates with the oil cup. This tube, *E*, forms a heating chamber for oil. The heater has a steam-inlet pipe, *G*, and an outlet pipe, H.

As steam is admitted through the pipe, *G*, the tube, *E*, is heated, and the heat from the oil therein contained is transmitted to that contained in the cup, so as to keep the cup-oil in liquid condition. This will be materially aided by the heat deflected by the concave top. The oil will pass in the usual manner up into the sight tube, and into the steam pipe through the passage *B*.

The inlet and outlet pipes, *G* and *H*, are situated somewhat above the bottom of the heater. Hence the hot water of condensation serves to heat the tube, so that a very small amount of steam is really necessary to heat the oil.

### Copper Smelting in Central Asia.

During his travels through Asia, Dr. Futterer saw some of the primitive copper smelting places, which he describes in his book, says the Trade Journals' Review. Near Tschadurkul there are vast forests which are utilized by the natives for smelting copper ore obtained from the Kaschgarian Mountains. The arrangements for this process are simple. In front of a clay hut are a number of furnaces, which are connected with bellows in the interior of the hut by an earthen pipe. The furnaces are filled with ore and charcoal up to the height of the tube, and covered up with clay, only leaving a small opening for the escape of smoke. The bellows consist of skins stitched together, open at one end, and are worked with two sticks. At the back of these furnaces or smelting troughs sits a man who attends continually to two bellows. When ready, the molten mass is run out, after a part of the furnace front is broken away, and the copper separates from the slag. In places where timber is not so plentiful, roots are often dug up for fuel.

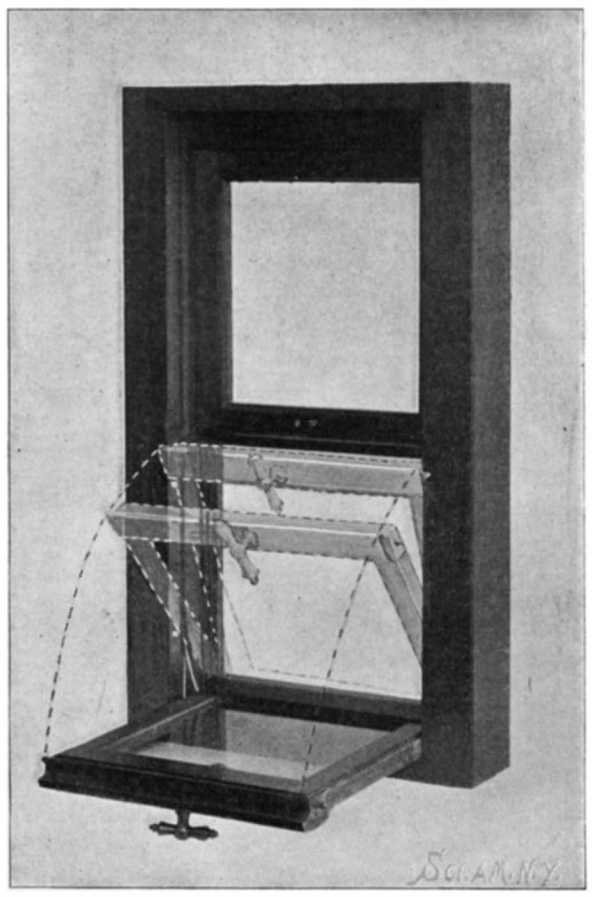
### THE BOGUE WINDOW SASH.

The windows with which most of us are familiar have often enough been condemned for the reason that the cleaning of the outer surface of the glass is attended with not a little danger. A recently patented invention which has been acquired by Mr. Arthur Hoyt Bogue, of No. 1 Broadway, New York, seeks to overcome this difficulty in a manner which is both ingenious and simple.

The sashes in Mr. Bogue's window run in vertical grooves in the window casing, and are provided with the usual pulleys and weights. Each groove of the lower sash, however, has a curved branch groove leading to the groove of the upper sash. Horizontal grooves bisect the two vertical grooves; and by these horizontal grooves pins projecting from the lower sash are guided. By reason of this arrangement of grooves, the lower sash can be moved in the branch groove directly in alignment with the upper sash, thereby closing the window far more tightly than is possible with the ordinary sashes. But if the lower sash be moved down to the end of its vertical groove, a horizontal space is left between the upper and lower sashes for ventilating purposes. If this space be not large enough, the sashes can be raised and lowered in the usual manner.

In the lower end of each groove of the upper sash a pin is located, which is received in the curved recess of a plate carried on the lower end of the lower sash. Thus the lower sash, when depressed, is pivotally mounted, so that it can be swung inwardly in the manner shown in our engraving, through an arc of 90 deg. When the sash is thus swung inwardly, the window can be safely cleaned.

For purposes of ventilation the sash can be held in two intermediate positions by spring stops mounted in the window frame. These positions are indicated in dotted lines in our engraving.

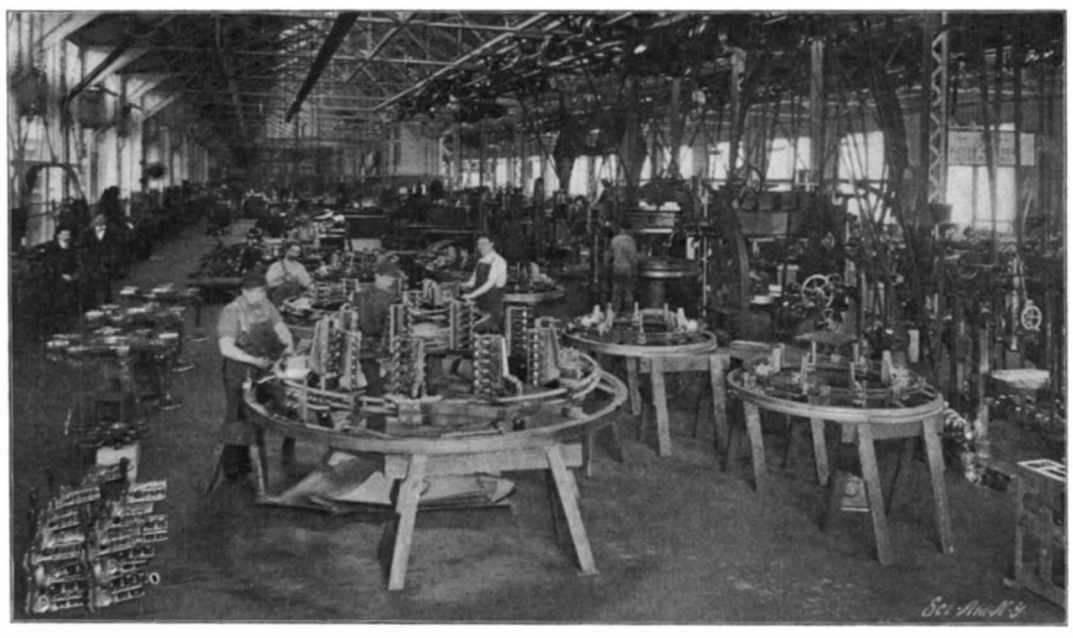


THE BOGUE WINDOW, SHOWING POSITION ASSUMED BY THE SASH.

### WORKS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

Of all the features of the great works of the Westinghouse Electric and Manufacturing Company at East Pittsburg, Pa., the most striking is the co-ordination of the various elements of the production, there assembled, according to a definite plan, thus making the works a unit and resulting in an astonishing efficiency of operation. Indeed, the keynote of the establishment is unity—the concentration of departments and their arrangements with reference to the progress of work from one department to another being carried so far as to bring a whole industry together under one enormous roof covering about 23 acres of floor space and housing more than 7,000 operatives of all grades. It is not out of place to speak here of the splendid organizing ability of Mr. George Westinghouse, the president of the company, who is alone responsible for the design of the work and the planning of the industrial operations here carried on with the highest possible efficiency.

The general arrangement of the works is as follows: The main shop building is over 1,200 feet long,



BRUSH HOLDER ASSEMBLING DEPARTMENT.

and is divided into four parallel bays, all of which are used as erecting shops. One of these bays is devoted entirely to the construction of street car motors; one for the building of small direct and alternating-current dynamo machinery, and the other two for the construction of larger machines. The widths of these four bays are respectively 80, 70, 80 and 65 feet, making the total width of the building about 300 feet. Throughout the entire length of each of these bays are provided runways for overhead electric traveling cranes, operated by Westinghouse direct-current motors. The various cranes are from 40 to 42 feet above the floor and of capacities ranging from 10 to 50 tons. A view of some of these cranes operating in one of the main bays is to be had from the illustrations. Alongside the machine shops, and, indeed, under the same roof with them, is a warehouse which measures 1,200 by 76 feet, and in the rear of this building are located the boiler and the engine rooms. Back of this building, but connected with it by a covered way, is the sheet-iron department, where the laminated material is punched, this structure being two stories high, 76 feet wide and 420 feet long. Across a yard and parallel with this building is another of like dimensions which is used as a brass foundry. There is also a large forge shop, a storage house for oils, varnish, etc., and another for castings. The bays of the last-named building are 170 feet wide and 390 feet long. Throughout the entire works ramifies a complete system of narrow gage railway tracks, and many sidings from the Pennsylvania Railroad run the entire length of all the principal bays of the buildings and of the warehouse.

Entering the main machine shop and erecting aisle the visitor is struck with two peculiarities: nearly every tool is independently motor-driven, and wherever it is possible each tool is portable. Each of the large shops with its tools can be regarded as a gigantic and complicated machine tool, of which the various parts can be interchanged and shifted with readiness as desired, the overhead cranes bringing the work to the tool or taking the tool to the work, whichever may be the more expeditious. A number of processes of great interest are carried on in the main shop, and we briefly mention some of them. In the bay devoted to the manufacture of railway motors are large and powerful milling machines furnished by the Ingersoll Milling Machine Company. In the second stage of the work on these frames an ingenious system of gang drills is in use, the frame itself being mounted on a turntable. This method of construction gives great accuracy in the shaping of these pieces, while the rapidity with which it is done is astonishing. The character of the work in the main assembling aisles is best understood by reference to the illustrations. Electrical machinery has grown more and more massive and some of the pieces handled to-day are of great size and weight. The cranes in use in these shops are equipped throughout with Westinghouse direct-current motors. The current supplied to these cranes is 550 volts, this being the pressure adopted for the general direct-current distribution throughout the factory. In all there are thirty-one electrical traveling cranes in the various bays of the building, many of the larger ones being equipped with auxiliary hoists of small capacity. The

equipment of machine tools in use in these shops is probably as fine as any in the world. It is everywhere evident that this is a manufacturing plant whose tools are specially designed for the work of producing and duplicating the various parts of electrical machines. In the testing department of the machine shop, and also in the main bays, large sections of the floor are built with cast iron slotted to receive T-head bolts somewhat like a planer bed, and upon these the heavy pieces of work and machines can be set up in proper relation to one another, or machines may be blocked upon them at short notice for the purpose of testing. Two phase current at 220 volts per phase is distributed for working a large number of induction motors from which individual machines and groups of machines are driven.

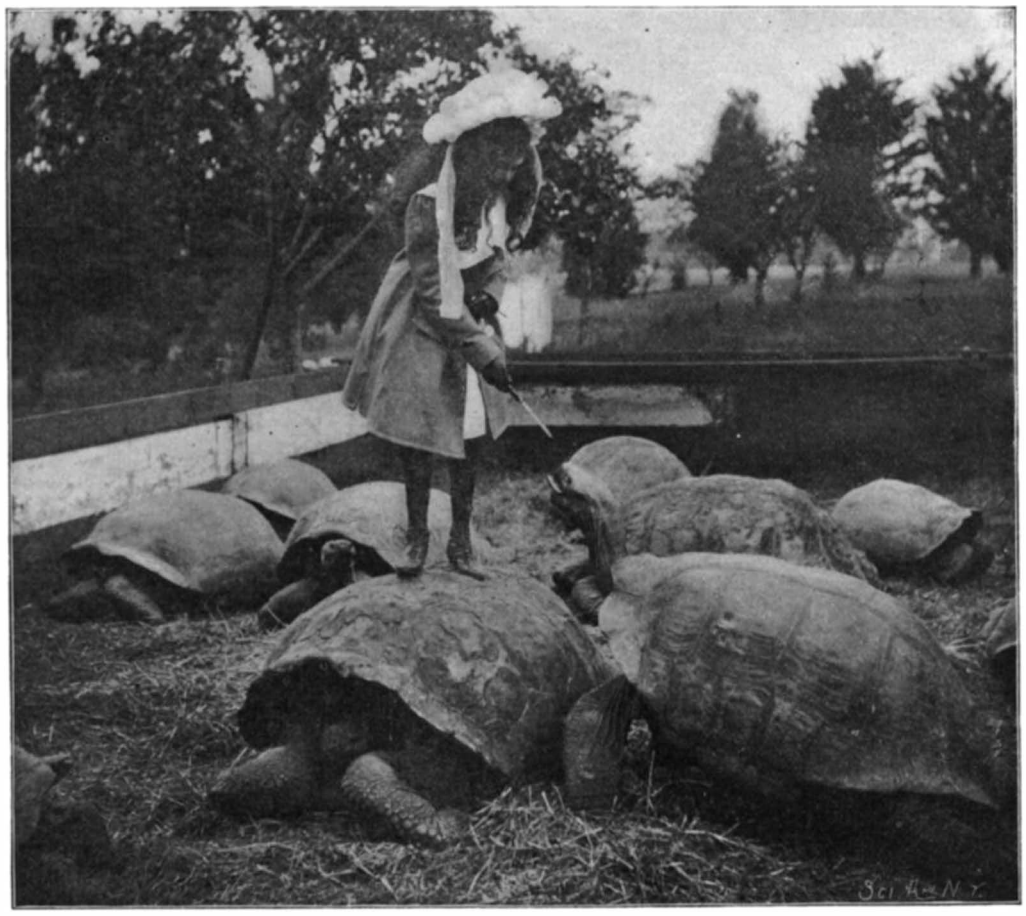
In the part of the building immediately back of the power house, work in sheet iron and the manufacture of disks and pieces intended to be built up into laminated armatures, pole pieces and field frames, is carried on. In the punching shops are punches handling work up to the largest size attempted in single pieces. No less than 200 machines are at work in the sheet iron department, this feature of electrical manufacturing having become of considerable importance, owing to the large number of alternating-current machines manufactured and the increased use of laminated pole pieces in direct-current apparatus. In this building also is punched the sheet iron for the manufacture of transformers, this industry consuming a large amount of material. Great perfection has been attained in the art of die-making, and the punched pieces are in proper condition to assemble without other treatment than annealing and japanning. The assembly of punched disks for the manufacture of armature cores is excellently illustrated in one of the engravings. Much of this work is done by boys, the illustration showing a group of them building up the cores for street-railway motor armatures.

The winding department is on one of the upper floors of the large main building. In these days the winding is practically all done by a process involving the making of coils ready to put in place upon pole piece or armature or in the transformer as may be desired. Ordinary coil winding or the manufacture of round or oval coils for fields, etc., is accomplished in the usual way, the coils for the most part being wound in metal forms thoroughly insulated as they are laid down and subsequently taped and cooked in japan or some other fluid insulating material which permeates all parts of them and hardens when cool. In one of the galleries of the main bay of the large building is located the mica department. More than 400 girls are employed in splitting mica and reducing it to standard thicknesses from which are built up the consolidated mica structures required in the various insulating operations. Ingenious machines for splitting mica are also in use. When the mica has been split into layers of the requisite thinness the sheets so made are built up into thicker boards. The consolidation is effected by a varnish of a special type which cements the thin sheets into thicker ones. These are placed in flat molds in which they are subjected to great pressure and considerable heat. The result is a material possessing extraordinary qualities of insulation, durability and dielectric strength.

One of the features of the company's manufacture is the building of transformers. This company probably holds the record for large transforming apparatus. Its output of this product is very great. One of the illustrations shows the assembling of transformers. High tension work has always been a feature of the Westinghouse company's engineering department, and it is turning out at present standard transformers of the oil-insulated variety for regular work at 50,000 volts. From these the transformers range down to those giving only a few volts for testing or for electro-chemical purposes. For testing the transformer product electrical pressures up to 125,000 volts are available. Ordinary testing, however, is confined to runs for a definite time upon full load and observation of heating supplemented by careful insulation tests at high voltages.

In the engine room are installed seven direct-coupled units, each of 400 kilowatts capacity at 220 volts, two phase. The engine part of each unit is the Westinghouse engine made in the Westinghouse Machine Company's works, which are situated but a short distance from the electric company's works. In addition to this installation is the gas-engine unit, whose engine was until lately the largest gas engine in the world. This engine of 650 horse power uses natural gas and runs at 150 revolutions per minute. It is direct-coupled to a 500-kilowatt, 550-volt, direct-current generator, which supplies current for the testing room and other purposes. It takes care of one of the most fluctuating loads that could be imposed upon it; notwithstanding, its regulation is excellent, and during the three years of its service it has given most satisfactory results. The engine is started by means of an auxiliary air compressor arrangement, an appropriate valve turning one of its three cylinders into an air cylinder at the moment of starting. There is also installed another gas engine, of the same pattern, of 250 horse power, direct-coupled to a direct-current dynamo. Power distribution throughout the establishment is by means of two-phase current at 25 cycles and 220 volts in each phase.

Throughout the Westinghouse works an unusual degree of care and attention has been paid to the comfort of the employes. For heating the buildings an indirect system is used, accomplishing at the same time a sufficient degree of ventilation. Fresh air is blown over coils of iron pipe heated by the exhaust steam from the boiler house, nine fan blowers, each operated by a 40 horse power induction motor, being used for this purpose. Perhaps more than in any other industrial establishment of an engineering character in this country the Westinghouse company has found employment for women. Of the 7,000 operatives in the East Pittsburg works more than 1,200 are women and girls.



THE TURTLES OF GALAPAGOS.

## THE TURTLES OF GALAPAGOS.

BY CHARLES F. HOLDER.

One of the most interesting places in the world, zoologically speaking, is the group of islands known as the Galapagos, forming the archipelago of that name. They lie about 500 miles west of South America, in the Pacific, directly under the equator, and number fifteen in all—Abingdon, Bindloes, Tower, James, Indefatigable, Barrington, Chatham, Charles, Hoods, Marlborough, Albemarle, Culpeper and Wenman being some of their names. They are volcanic islands, the results of various eruptions in the past, over 2,000 craters being seen in various parts, some rising to an altitude of 3,000 or 4,000 feet, their sides broken with smaller craters.

In appearance the islands present a barren and uninviting exterior, masses of lava and fields of black basalt extending in every direction. Chatham Island, about 30 miles in extent, has in some portions the appearance of a pepper box, so numerous are the blow holes. Albemarle is particularly cyclopean in its aspect, being covered with lava and abounding in craters, some of which are still smoking; eruptions have occurred during the past century. On Chatham Island there is a small penal settlement, but the entire group is frequented only by whale, guano, and turtle hunters from the mainland of Chili or Ecuador. The fauna of these islands has always interested naturalists, being unique, the various animals in many instances being confined to this barren spot; more remarkable yet, the animals of the various islands of the group show a marked specific difference.

It is probable that not many ages ago the Galapagos Islands were unborn, at least such is the inference of many who have examined them; yet among the animals which make up the fauna are several that are found nowhere else upon the globe—facts suggesting interesting possibilities to those who make the development of life a special study. Among the animals of interest found here are the turtles of the genus *Testudo*, a group of which is here shown. Originally the turtles were found all over the islands of the group, but so great has been the demand for them that they have become restricted to the larger of the islands. They are land tortoises, attaining a weight of several hundred pounds, some being so heavy that six or seven men are required to lift them. On numbers of the islands the visitor will find singular trails leading from the lower altitude to that of 1,000 or more feet. These paths are the trails of the turtles, which in the arid islands are obliged to crawl to the upper regions to obtain water; on some of the islands there is no water, the tortoises depending upon cacti for their supply. These animals present a remarkable, indeed uncanny, appearance as they crawl along over the volcanic masses; winding in and out among the singular craters, in shape and habit singularly adapted to their surroundings. The male is the largest, and possesses a long tail by which he may be distinguished from the female. The shell is large and domelike, and when the animal is walking the top of its back, in old individuals, is three feet from the ground. The neck is long, the head very small in proportion to the body, giving the animal a very quaint appearance. The creature is a vegetarian, living on the cactus on some of the islands, depending upon it for both food and drink; and on others upon lichens, leaves of various kinds and berries. Where fresh water is plentiful the tortoises display a great partiality for it, entering the muddy springs, which are found at altitudes of from 1,000 to 1,500 feet on the upper islands, plunging their heads into the water with the greatest enjoyment, often remaining in the vicinity for several days.

At these places the tortoise hunters search for them, with good success. The animals present a singular appearance when walking and can easily carry as much as can be piled upon their backs. Three men, possibly, could be carried, one easily. Darwin in his visit to the islands made some interesting observations regarding their rate of speed when walking. By following an individual he found that it moved 60 yards in 10 minutes, or about 4 miles a day; but the residents of the island state that they can crawl faster than this. The male appears to have a voice, uttering a loud resonant bellow which can be heard some distance. This is confined to the breeding season; at other times the only sound uttered is a hiss. On the islands where sand abounds the females deposit their eggs in it, digging a hole, much after the manner of sea turtles, the sun hatching the eggs. On other islands, where lava covers almost everything, the eggs are dropped among the rocks in fissures. The eggs are a little larger than hen's eggs, spherical, and seven inches in circumference.

How long these turtles live is a matter of conjecture; individuals 80 years of age are known. The adults have no enemies except man, but the young are preyed upon by buzzards. That the tortoise is an aboriginal inhabitant of the islands there can be little doubt, and, as previously stated, it is claimed that the individuals from the various islands differ specifically. Gunther describes six species. Vice-Governor Lawson, of the islands, informed Darwin that the difference was so marked that he could easily designate the animals from certain islands. The tortoises constitute an important article of food for the inhabitants of the islands; nearly every ship that puts in sends out a hunting party for them, and tortoise hunters go regularly every year to the islands from the coast of South America and take large numbers for the meat, which is dried, and for the oil.

The animals were probably first observed by Dampier, in 1680. The Spaniards named the islands for the turtles, which in former times existed there in great numbers, and all navigators following levied

on them. In 1813 Porter, of the famous "Essex," found tortoises on the following islands: Marlborough, James, Charles, and Indefatigable, and he states that they differed on the several islands. In 1835 Darwin visited the islands and found the number greatly reduced. In 1846 H. M. S. "Herald" reported that the tortoises were extinct on Charles Island, and in 1875 Captain Cookson reported that but a few were left on Chatham Island. Up to 1870 whalers were continually in port, each carrying away from one to 100 tortoises, as the animals would live for several months on deck without food and were a welcome addition to the larder. F. A. Lucas estimates that 6,000 were taken from Charles Island alone, and that the total number taken from all the islands would reach into the millions.

The penal colony of Ecuador was established on Charles Island in 1829. The tortoise became the principal article of food and was rapidly killed off. The oil produced by the fat was an attraction, and in 1875 Captain Cookson found a party on Albemarle that in a few months had secured 3,000 gallons of oil, which meant the destruction of over that number of tortoises. From this time on the animals were slaughtered without mercy, dogs and men joining in the work of extinction, until in 1888 the "Albatross" landed there for the purpose of obtaining a set of the different species. But it was too late, apparently, as but a small number of the reptiles were secured, and no large ones, 40 pounds being the greatest weight—a contrast to the 870-pound specimen from Aldabra, or the 200-pound individuals common in Darwin's day. The hunters often cut open an animal to see if it is fat, releasing it if it is not, the wound healing—a practice in its cruelty being only equaled by the men who take the plates from the living hawksbill turtle by heating the shell, then releasing the animal that has doubtless suffered excruciatingly. Formerly the tortoises were found in great numbers. Vessels have taken as many as 700 at a time, and brigs loaded with them have carried them to the South American coast. Every ship which lands at the islands levies on the remarkable animals, and doubtless in a few years they will have disappeared. The last vessel-load of tortoises landed at San Francisco recently. They were taken into the country and an effort is to be made to propagate them; a small herd is being kept at the National Zoological Garden with the same object.

The accompanying illustration shows the Californian herd, if such a term can be applied to a collection of turtles. The reptiles are of large size, extremely docile, permitting children to ride on their backs, dropping to the ground suddenly when struck, uttering a loud hiss. The animals have readily adapted themselves to the new order of things and eat almost any vegetable. The collection of huge tortoises, with long, extended necks and diminutive heads, stalking about, dropping with a crash to the ground, hauling in all the members on the instant at the slightest alarm, is an extraordinary spectacle, and it is doubtful if there are living any more interesting creatures than these solemn aborigines of the Galapagos Archipelago.

### International Good Roads Congress.

The Office of Public Road Inquiries is in receipt of a call for an International Good Roads Congress to be held in the city of Buffalo, State of New York, September 16 to 21, 1901. The call is issued by the National Good Roads Association of the United States.

The association, in co-operation with the Illinois Central Railroad and the Government Office, has just completed a very successful good roads campaign in the States of Louisiana, Mississippi, Tennessee, Kentucky, and Illinois. Over twenty miles of earth, gravel, and stone roads were built and several large, enthusiastic conventions held. Thousands of people flocked to see the practical work of the "Good Roads Train" and to participate in the deliberations of these conventions. This work has aroused great interest and enthusiasm throughout the country for better roads, and the Buffalo Congress will further promote this interest.

### Mineral Salts and Assimilation.

E. A. Newell Arber derives the following general conclusions from a series of experiments on *Ulva latissima*. Distilled water is, after a short time, fatal, owing to the absence of dissolved salts; with tap water a large amount of carbon assimilation takes place, but the maximum (in the case of *Ulva*) only with sea-water. Sodium chloride seems to be absolutely indispensable, in the case of marine plants, for only a moderate amount of assimilation; the maximum degree of concentration with this salt appears to be between 1 and 5 per cent. None of the other salts which form the principal ingredients of sea-water can take its place, and the absence of any one of them, provided the others were present in normal quantities, did not inhibit assimilation, while the presence in distilled water of either calcium sulphate or potassium chloride appears to inhibit carbon assimilation almost absolutely.—Annals of Botany.

### Boiler Inspection in France.

The laws governing boiler inspections in France are exceedingly liberal, which does not imply that they are exceedingly safe to the public. Boilers must be inspected when made, when repaired, and when changing owners; also every tenth year anyhow. "Voluntary inspection," whatever that may be, must be at "reasonable intervals."

### The Current Supplement.

The current Supplement, No. 1339, is a most interesting number. "Biskra, the Queen of the Oases," lies not far from the northeastern edge of the Sahara, and it was recently visited by our Paris correspondent. "Earth Carving" is a lecture by Prof. W. B. Scott. "Anatomy and Habits of Fish" is a fully illustrated article and describes parts of fishes in detail. "On Sea Charts Formerly Used in the Marshall Islands" describes charts of a curious nature used by the chiefs. "American Locomotives in England—III." is continued. The usual "Trade Suggestions from United States Consuls" and "Trade Notes and Receipts" and "Selected Formulæ" are published.

### Contents.

(Illustrated articles are marked with an asterisk.)


Automobile news ..... 134
Boiler inspection in France ..... 140
Boiler testing, points on ..... 136
Bridge, cantilever* ..... 132
Comet, Encke's ..... 134
Copper smelting in Asia ..... 138
Electric and Manufacturing Company, Westinghouse* ..... 129, 138
Electric incline, Palermo-Monreale* ..... 133
Engineering notes ..... 134
Fiber, palm leaf ..... 137
Germany's industrial crisis ..... 140
Hair, causes of white ..... 134
Heavens in September ..... 134
Inventions, index of ..... 141
Inventions, recently patented ..... 140
Iroquois, lengthening of the* ..... 136
Lubricator and heater* ..... 138
Mineral salts ..... 140
Minot, C. S.* ..... 131
Mower, automobile* ..... 132
Negatives, advantage of paper ..... 131
New York, improvements in ..... 130
Nobel prizes, award of ..... 134
Photographic plate, immense ..... 133
Porto Rico, exports to ..... 131
Railway systems of the United States ..... 130
Roads, congress on good ..... 140
Science notes ..... 134
Supplement, current ..... 140
Turtles of Galapagos* ..... 139
Window sash, Bogue* ..... 138


## RECENTLY PATENTED INVENTIONS.

### Electrical Apparatus.

ELECTRIC TRACTION-MOTOR.—Charles Richter and Richard T. Eschler, 95 Federal Street, Camden, N. J. The invention is an improvement upon an electric motor patented by these inventors in 1900. The novel features of the improvement are to be found in the special construction of the wheel-plates and tire forming the motor-case, in the arrangement of motor-bearings for sustaining and concentrically holding the axle and field-magnets, in the means for providing for the end-thrust of the independently rotating wheel in the direction of its axis, and in the means for cushioning or holding the axle and attached field magnets elastically against the torque.

SECONDARY ELECTRIC CLOCK.—Fidelis Lucking, Detroit City, Minn. The invention belongs to that class of electric clocks which are operated by a current sent periodically from a controlling clock; that is, a clock arranged to close a circuit at regular intervals. The object of the present invention is to provide a clock of this class which is simple, effective in operation, which requires little power, and which is not liable to get out of order. The hands can easily be set.

TROLLEY-WHEEL.—William C. Cottrell, Asbury Park, N. J. The wheel consists of inner and outer sections independently revoluble, and annular plates secured to the side faces of one section and projecting into engagement with the side faces of the other section to hold the two sections engaged. The plates have annular projections extending inwardly between the sections of the wheel to form a bearing surface for one upon the other. The trolley-wheel runs easily and insures proper feeding of the current to the motors.

ELECTRIC AUTOMOBILE-MOTOR.—Charles Richter and Richard T. Eschler, 95 Federal Street, Camden, N. J. The invention consists of a combination of an electric motor with a wheel, the motor being adapted to operate the wheel directly without the intervention of gearing, such construction being provided as to make the combined wheel and motor strong and durable as well as electrically correct. The interior of the wheel can be easily reached, and the field magnet and connected parts withdrawn.

### Mechanical Devices.

GAS-LAMP LIGHTING OR EXTINGUISHING APPARATUS.—Vittorio Croizat, Turin, Italy. The invention provides means for lighting and extinguishing street gas-lamps from an office or station. The apparatus is worked by varying the pressure in the gas mains, and is so arranged that when the pressure is raised beyond a certain limit the lamps are lighted, and when the pressure is lowered to a certain extent they are extinguished. Ordinary pressure is not interfered with, except during the short periods when the lighting and extinguishing takes place. Thus, there are three distinct pressures by which the devices are controlled. At each lamp there is a small lighting-flame always burning; and the raising of the pressure opens a passage for gas to the main burner which is kindled by the lighting-flame.

REGISTER.—Howard H. Breeden, Millville, N. J. The object of the invention is to provide a pool-room register arranged to enable the proprietor to control the number of players at a table, the number of games played, and to give the total of the day's games and a grand total of the games for a given period.

PUMP.—William C. Whittaker and Walter V. Turner, Raton, New Mexico. The pump is arranged to work either as a single or double-acting pump, the operating power in either case being equally divided between the up and down strokes of the piston. The pump consists of a main cylinder in a well, and an auxiliary cylinder located midway between the water-level of the well and the discharge of the water. The auxiliary cylinder is located in the discharge back of the main cylinder. In these cylinders pistons reciprocate, the main-cylinder piston being hand or power driven, and the auxiliary piston receiving its down-stroke from the piston-rod of the main-cylinder piston and its up-stroke from the water lifted by the main-cylinder piston. A suction-valve for the cylinder is controlled from the governor on a motor.

POLISHING-MACHINE.—George A. Ensign, Defiance, O. Mr. Ensign has devised for the Defiance Machine Works an automatic machine for rapidly and accurately polishing or finishing handles of brooms, rakes, and other implements, or curtain-poles, pike-poles, and other round work of any desired length. The machine has oppositely-disposed polishing-belts which pass over driven pulleys and over adjusting pulleys. Parallel rock shafts carry the supports for the adjusting-pulleys. By rocking the shafts the adjacent runs of the belts are moved toward or from the work. Positively-actuated feeding devices are in axial alinement on opposite sides of the belts, one of the devices serving to feed the unfinished work between the belts, and the other device receiving the finished work and discharging it from the machine.

### Vehicles and Their Accessories.

TRUCK.—Jacob L. Barrick, Wellington, O. The truck is particularly adapted for the carrying of pallets of brick. The object of the invention is to provide a truck of this character with a simple means by which the side-rails of the body portion or upper deck may be simultaneously raised or lowered.

AUTOMOBILE VEHICLE.—Alden E. Osborn, 2048 Valentine Avenue, Bronx, New York city. In three-wheel motor-vehicles the steering-wheel is usually pivoted as in a bicycle. While this construction may be permissible in very light vehicles, it is dangerous, owing to the severe strains on the fork-crown and frame-bars, which bars have to be curved, and therefore cannot resist strains without being made excessively heavy. It is one of the objects of this invention to overcome these defects, which it does by mounting the steering-wheel through a pivoting device on an axle which is stationary and can therefore be connected by straight tubes directly to the rear axle, thus doing away with the cost and weight of the fork and a large part of the frame tubing, while the shorter connecting tubes which are used can be much lighter and bear more strain because they are straight. Another feature is a method of securing detachable parts to a vehicle having one seat, so that it can be quickly converted into a very neat dos-à-dos, surrey, or delivery wagon, thus permitting one vehicle to serve for business or pleasure and presenting a type of automobile which will please many who could not afford more than one motor-vehicle and still need a vehicle for different purposes.

### Tools.

CAP-CRIMPING TOOL.—Harry Cogeen, Goldfield, Col. The invention is an improvement in devices for crimping the caps on the fuses commonly used by miners. The construction is simple, inexpensive, free from complications, and provides within the means of every miner a tool which combines the merits of a knife and a cap-crimper, in which the cap-crimping part in connection with the handle can be readily removed and replaced whenever desired.

TOOL FOR PAPER HANGERS OR OTHER MECHANICS.—Irving L. Hawkins, Windsor, N. Y. This tool is arranged more especially to permit the user readily to smooth the paper on the wall, properly to roll down the lap at the joint of adjacent papers, and to permit the quick trimming of the ends and the side edges of the paper. The tool is a brush having a pivoted blade arranged in a longitudinal recess in its back. A roller is also provided for flattening down the paper.

PLIERS.—John L. Ogle, Maitland, Mo. The pliers are used to grip and turn bolts or pipes. The particular construction devised by Mr. Ogle affords a considerable range of lateral adjustment for the gripping jaws, thus adapting the tool for very effective use on bolts or pipes of various diameters. The tool is self-adjusting when applied, so that it will automatically grip and hold the pipe or bolt.

BENCH-VISE.—George W. Norton, Philadelphia, Pa. The vise is adapted particularly for use in manual training institutions, and is of that class in which a movable jaw is provided and works against the edge of the bench. Under the former construction of devices of this class the shrinking of the top of the bench rendered the operation of the movable jaw of the device rather difficult. This difficulty has been overcome by means of slotted lugs on the guide-bars, the slots permitting an easy adjustment of the guide-bars to counteract any shrinking in the top of the bench.

### Railway Contrivances.

SWITCH.—George W. Cantrell and William J. Empey, Spokane, Wash. The invention provides a switch for street railways which can be operated to throw the switch-tongue from the driver's platform. The parts are so placed that they are at all times thoroughly lubricated and protected from freezing and from grit or sand, thus preventing undue wear.

SWITCH.—George Moore, Ellsworth, Iowa. This switch is arranged to permit the engineer of the train to unlock and open the switch to pass, for instance, from the main track upon a side-track, and then to lock the switch in an open position, or to pass the train from the side-track back to the main track, and again to close the switch and lock it—all without the assistance of switch-tenders and without stopping the train.

PRESS.—John S. Peter, Fort Worth, Tex. The press is intended particularly to force tie-plates into railway-ties, and comprises a yoke having bearings in its upper portion for a shaft. A cam is carried on the shaft, and has a steadily-increasing radius. The cam serves the purpose of forcing the flanges of the tie-plate into the tie.

### Miscellaneous Inventions.

SQUIB.—Timothy F. Clarke, St. Clair, Pa. This blasting squib is completely moisture-proof and is provided with a transparent body to permit the user to ascertain at a glance the condition of the charge, so as to insure perfect safety when using the squib and to guard against possible accident from premature explosion or miss through defective construction.

### Designs.

KNIFE.—John H. Wray, Danville, Pa. From the handle a tang projects laterally, which tang terminates in a curved blade.

SNAP-LINK.—Augustus Brockelbank, Ossining, N. Y. The snap-link includes two opposing loops, formed of a single piece of material in the shape of a figure 8. The link can be used on harness, on garments, and the like.

CUP.—Harold L. Wheeler, Buffalo, N. Y. The cup is a loving cup having two cup-sections mounted upon a single base.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

**MUNN & CO.**

Marine Iron Works. Chicago. Catalogue free.

**Inquiry No. 1250.**—For manufacturers of cutters to be used in shaving and dust collecting pipes.

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

**Inquiry No. 1251.**—For manufacturers of machinery for making buttons from mussel shells.

"U. S." Metal Polish. Indianapolis. Samples free.

**Inquiry No. 1252.**—For manufacturers of ice-making machinery. (Kansas City or Chicago firms preferred).

Spring motors. Smith Novelty Co., Hopewell, N. J.

**Inquiry No. 1253.**—For manufacturers of pine needle pillows.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

**Inquiry No. 1254.**—For the name and address of party who make the Piper physician's battery.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

**Inquiry No. 1255**—For manufacturers of butcher knife handles.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

**Inquiry No. 1256.**—For manufacturers of small laundry plants.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

**Inquiry No. 1257.**—For small ice-making machines with capacity of 300 to 500 pounds daily.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

**Inquiry No. 1258.**—For fans for cooling purposes run by spring motor.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

**Inquiry No. 1259.**—For small motor to run a fan or cream freezer to one-quarter horse power.

Articles made of iron, steel, brass, copper, aluminium. Metal Stamping Company, Niagara Falls, N. Y.

**Inquiry No. 1260.**—For manufacturers of the new change-making machine.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

**Inquiry No. 1261.**—For fountain pens for delicate recording instruments.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

**Inquiry No. 1262.**—For dish-washing machines.

WANTED.—Punch and die work, press work and light manuf'g. Daugherty Novelty Works, Kittanning, Pa.

**Inquiry No. 1263.**—For umbrellas to open and close by pressing a button or spring.

Kester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chicago, Ill.

**Inquiry No. 1264.**—For manufacturers of novelties.

SASH BALANCE.—Raises and locks window. Cost 30 cents set. Patent for sale, cheap. "Brune," Little Ferry, N. J.

**Inquiry No. 1265.**—For a small second-hand electric plant capable of running one hundred 16 c. p. Edison lamps with or without steam engine.

For Machine Tools of every description and for Experimental Work call upon Garvin's, 149 Varick, cor. Spring Streets, N. Y.

**Inquiry No. 1266.**—For a drill capable of drilling hard metal.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

**Inquiry No. 1267.**—For an apparatus for collecting gas from blast furnaces and using same for operating gas engines.

INVENTORS, ATTENTION!—Incorporate your companies in South Dakota. Charter fee, $10. Laws most liberal in United States. Address Box 6, Pierre, S. D.

**Inquiry No. 1268.**—For manufacturers of toys and childrens' novelties.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

**Inquiry No. 1269.**—For manufacturers of porcelain shutter knobs.

WANTED.—A patent to manufacture. Must be something that does not at first require large expenditure, and something that will sell by judicious and attractive advertising. State price expected, if for sale, and royalty if not. H. A. Bubb, 546 Delaware Ave. Buffalo.

**Inquiry No. 1270.**—For manufacturers of cork tapering machines.

I want to buy one-half of an established manufacturing business that is making some money. Must bear investigation. References exchanged. S. Jackson, 104 Bowery Street, Akron, Ohio.

**Inquiry No. 1271.**—For manufacturers of reversing clutches for marine gasoline engines.

WANTED.—General agency for a patented mechanical article. J. E. Alden, Gen. Del. P. O., Buffalo, N. Y.

**Inquiry No. 1272.**—For a machine for cutting, drying and pressing artificial flowers.

INDUSTRIAL OPPORTUNITIES.—The Industrial Department of the Lackawanna Railroad, in charge of William B. Hunter, and having its headquarters at 26 Exchange Place, New York City, has just issued a 500-page booklet under the caption, "Industrial Opportunities.' This work treats of every town on the line, showing its population, its distance from New York and from Buffalo, its railroad facilities, its leading industries, its leading shipments, its rate of taxation, cost of labor, rent of houses; how lighted, whether it has water works or not, its principal power, approximate cost of steam coal, approximate value of lands and describing vacant lands or factories available for manufacturing purposes. The advantages of this line in the mining regions of New Jersey and Pennsylvania and the agricultural districts in the State of New York are fully set forth. Copies of the book will be forwarded on application to the Industrial Department.

**Inquiry No. 1273.**—For manufacturers of machines for wrapping soap.

**Inquiry No. 1274.**—For manufacturers of papier maché or wood pulp pressed in sheets to be used for ceilings or paneling.

**Inquiry No. 1175.**—For manufacturers of machines for making envelopes.

## Notes & Queries

HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

**Buyers** wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Books** referred to promptly supplied on receipt of price.

**Minerals** sent for examination should be distinctly marked or labeled.

(3345) G. W. asks: 1. How many 16-candle power incandescent lamps will a horse power generate off a dynamo? A. Ten is the usual number, 2. Where can I get a book or paper that tells how to build a small dynamo, about 5 horse power? A. SUPPLEMENT 865, price ten cents, contains the plans of a machine which is very nearly what you require.

(3346) A. B. asks: 1. What is an induction motor? A. An induction motor is one which operates by the action of a rotary magnetic field upon a short-circuited armature. 2. In making a pattern for an iron casting should any allowance be made for the contraction of the metal upon cooling, and if so, how much? A. For casting in which the thickness is about one inch an allowance of 1/8 inch per foot is made. Thicker castings will shrink less and thinner ones will shrink more than this. The quality of the material and the manner of molding and cooling will also make a difference. 3. In SUPPLEMENT No. 1124 is the wire referred to for the secondary coil single or double silk-covered? A. Single silk-covered wire is to be used. 4. Will double cotton covered wire answer for the above purpose? A. This covering takes up too much room. Silk is no better than cotton except that it is finer. Neither are any better than the same air space. They both are porous and contain air. They keep the wires from touching, but the air insulates, till the air is driven out by paraffine, or some similar substance. 5. Refer me to a good book on the construction of large induction coils, and to one on the construction of dynamo-electric machinery, including alternators and transformers, if possible. A. Hare's "Large Induction Coils: A Workshop Handbook"; price $2.50 by mail. Thompson's "Dynamo-Electric Machinery," with its "Supplements." The main volume costs $6. The supplement on "Polyphase Electric Currents" costs $5.

# INDEX OF INVENTIONS

**For which Letters Patent of the United States were Issued for the Week Ending**

**August 20, 1901,**

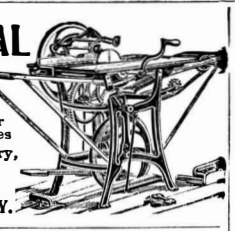
**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]

Acid, apparatus for concentrating sulfuric, J. L. Kessler ... 680,867
Acid, making nitric, C. Uebel ... 681,085
Air brake, G. W. Edington ... 681,045
Air compressor, hydraulic, A. G. Waterhouse ... 680,951
Air to movable motors and hoists, apparatus for supplying compressed, W. M. Farrar ... 680,849
Alloy, copper, B. S. Summers ... 680,819
Alloys of iron or steel, manufacture of, Chavot & Hozana ... 680,694
Amalgamator, A. R. Black ... 681,034
Arrastre or scouring mill, A. R. Black ... 681,033
Atmospheres and temperatures, maintaining specific, W. J. Knox ... 680,781
Automatic brake, E. A. Edmunds ... 680,706
Automobile, W. C. Smith ... 680,891
Automobile, A. Thompson ... 680,899
Axle turning and threading device, portable, E. F. Bond ... 680,756
Axle wheel, W. Hoerger ... 681,120
Baling press, Hill & Hightower ... 680,712
Baling press, R. E. Chapman ... 680,841
Basket making machine, S. D. Locke ... 680,721
Bed, invalid's, P. C. Smith ... 680,814
Bedsteads, detachable guard rail for, H. A. Tobey ... 681,154
Belt connection, chain, G. L. Holmes ... 680,920
Bending machine, G. W. Bugbee ... 680,760
Bibycle, H. G. Johnson ... 680,980
Bicycle propelling mechanism, P. G. McCollam ... 680,725
Boats, etc., apparatus for raising or lowering ships', A. Welin ... 680,823
Boiler, B. D. Coppage ... 680,696
Bookbinding machine, J. McClellan ... 680,802
Bottle closing device with cork stopper, H. P. H. Clasen ... 681,104
Bottle, non-refillable, F. A. Woods ... 680,905
Bottle stoppers, device for attaching rubber washers to, F. Leu ... 680,870
Brace, P. F. Maines ... 680,931
Brick kiln, G. F. Gray et al ... 680,914
Bridge, counterbalanced and jointed suspension, F. J. Arnodin ... 680,906
Bristle probang, R. P. McCully ... 680,936
Brush, N. Stow ... 681,148
Brush, rotary, J. E. Compton ... 680,990
Buckle, belt, I. Lewenthal ... 680,929
Bugy top releasing device, J. T. Prouty ... 680,735
Butter cutter, W. H. Noack ... 681,068
Button drilling machine, H. Chalmers ... 680,909
Button, link cuff, E. A. Lehmann ... 681,028
Calling key for party lines, selective, F. R. McBerty ... 680,881
Cameras, appliance for adjusting and working shutters and diaphragms of photographic, A. Watkins ... 681,087
Can filling machine, F. E. Caton ... 680,762
Can holding device, J. F. Kieley ... 680,925
Can opener, E. S. Lefler ... 680,869
Can opener, J. L. Conner ... 680,910
Cannon, breech-loading, C. H. Griffith ... 681,021
Car brake, H. Wise ... 680,904
Car door fastener, W. H. Swank ... 681,150
Car, double deck, W. E. Sharp ... 680,944, 680,945
Car, dumping, Stone & Sharp ... 680,817
Car fender, J. D. Wintz ... 680,955
Car signaling device, Ward & Kean ... 680,901
Cars, brake lever system for railway, N. A. Christensen ... 681,103
Carbids, making, H. S. Blackmore ... 681,096
Carbureter, A. C. Sargent ... 680,941
Carbureter for explosive engines, H. H. Buffum ... 680,961
Carriage running gear, baby, D. Neilly ... 680,727
Carriage running gear, horseless, G. J. Loomis ... 681,062
Carriage spring, S. R. Bailey ... 681,093, 681,094
Cartridge wad, C. E. Adamson ... 681,091
Casket cover fastener, W. H. Pidrick ... 681,136
Caster, L. H. Kennedy ... 681,123
Casting, J. H. Kelley ... 680,924
Centering machine, duplex, F. W. Mussetter et al ... 680,724
Chalk holder, Day & Hall ... 680,702
Checkrein securer, L. O. Snell ... 680,946
Chlorin and treating ores with same, generating, E. D. Kendall ... 681,059
Chopper. See Cotton chopper.
Chronometer escapement, J. F. Thim ... 681,006
Cigarette former, T. F. Foley ... 680,708
Cigarette maker, H. H. Harrison ... 681,053
Clamping apparatus, Hassler & Watters ... 680,8 59
Clarifying apparatus, C. R. Hudson ... 681,170
Clasp, Watt & White ... 681,088
Clothes line, J. H. McBride ... 680,882
Clutch, cone friction, E. E. Thomas ... 681,152
Clutch, friction, E. Turney ... 680,900
Cock for steam boilers, gage, R. J. Flinn ... 680,993
Coffee compound and making same, J. M. Schutz ... 680,889
Coffee pot, distillation, W. A. Barrington ... 680,958
Coin carrier, Henry & Herrmann ... 680,995
Coin controlled mechanism for prepayment meters, Marland & Large ... 680,875
Coke and gas manufacturing apparatus, W. J. Knox ... 680,791
Coke, apparatus for the manufacture of, W. J. Knox ... 680,790
Coke, manufacture of, W. J. Knox ... 680,783
Coke, manufacturing, W. J. Knox ... 680,780
Coke ovens, drawing machine for, R. D. Martin ... 681,064
Collar, J. Dunning ... 681,114
Concentrator, A. B. Paul ... 680,938
Conduit, C. A. Wanner ... 681,158
Cooking apparatus, T. L. Tremblay ... 680,746
Corn crushing and cutting machine, J. S. Bloom ... 680,755
Cornstalk loader, O. B. Jacobs ... 680,979
Corset, I. W. Birdsey ... 680,960
Cotton chopper, A. L. Hockett ... 680,976
Cotton press, W. M. Thomas ... 681,082
Counting of money or the like, device or implement for facilitating the, R. W. Hawley ... 681,054
Cover for pots, kettles, etc., C. H. S. Helling ... 680,917
Cowl, Jordan & Schingel ... 680,865
Crank pins, etc., machine for turning off, C. F. Owen ... 681,071
Crystallizer, C. A. P. Turner ... 680,949
Cuff holder, J. Jungbauer ... 680,715
Cuff holder, G. B. Adams ... 680,956
Cultivator attachment, sulky, L. Holcomb ... 680,713
Curling iron heater, A. Firth ... 680,851
Curling iron heater, E. T. Rosenheimer ... 680,940
Curvature, etc., apparatus for the treatment of, Wegner & Repke ... 681,174
Cutting machine, bias, F. H. Brewster ... 681,015
Cycle mud guard, W. J. Stevens et al ... 680,816
Damming torrents, means for, G. Serrazanetti ... 680,738
Delivery switch, C. M. Johnson ... 681,057
Depurator, R. J. Maurer ... 680,723
Dining room service apparatus, J. B. Hurd ... 681,122
Disinfectant holder, D. N. Calkins ... 681,100
Disinfecting apparatus, M. Sheridan ... 680,812
Display mount, S. F. Denton ... 681,110
Display rack for mattresses, etc., G. E. Distelhurst ... 680,965
Door closer and fly scare, combined, J. E. Hadley ... 680,857
Door hanger, A. S. Hook ... 680,996
Dress shield fastener, C. A. See ... 681,141
Drill, T. P. Blake ... 681,035
Drills, machine for producing twist, C. D. Wiley ... 680,903
Dye, blue acid, H. Polikier ... 680,732
Dyeing thiosulfate colors, Green & Meyenberg ... 681,117
Dyer's identification tag apparatus, C. Morgan ... 680,877
Educational purposes, transmitter for, C. S. Comins ... 680,695
Electric furnace, A. H. Cowles ... 681,107
Electric generator, dynamo, B. G. Lamme ... 680,793
Electric light support, incandescent, H. Gilpatric ... 680,913
Electric lighting on constant-current circuits, system of, H. N. Potter ... 680,809
Electric motor starting apparatus, T. S. Perkins ... 681,133
Electric switch, M. H. Johnson ... 680,981
Electric switches, carbon break for, H. D'Olier, Jr. ... 681,112
Electric traction road, L. Dion ... 681,704
Electrical controller attachment, Fairbrother & Mathewson ... 681,167
Electrical machines, strap coil for, J. P. Mallett ... 680,795
Electrode for electric batteries, zinc, W. Erny ... 680,848
Electromagnetic motor or reciprocating engine, R. D. Mershon ... 680,797
Electromotive force, mechanism for generating variable, J. E. Miller ... 680,798
Elevator, W. F. Leonard ... 680,871
Elevator attachment, E. R. Stoddard ... 680,895
Engine. See Explosive engine.
Engine house appliance, Spring & Long ... 681,081
Engine lubricating device, gas, G. A. Thode ... 680,820
Engine speed regulator, explosive, Brellier & Marius ... 680,758
Engine starting device, explosive, T. B. Jeffery ... 680,823
Engines, sparking igniter for explosive, L. L. Palmer ... 680,884
Explosive engine, C. W. Weiss ... 680,953
Explosive engine, multiple cylinder, A. F. Bardwell ... 680,907
Explosive engine, multiple piston, W. S. Sharpneck ... 680,985
Explosive engine, self-starting, E. N. Dickerson ... 681,111
Eyeglasses, O. P. Bailer ... 681,092
Fastening device, E. M. Hembree ... 680,711
Faucets and their connections, apparatus for cleansing, R. Birkholz ... 680,836
Fence machine, wire, J. M. Barber ... 681,031
Filter, R. T. Weaver ... 680,902
Filter for purifying water, Avezard & Clerc ... 680,681
Fire alarm, automatic, C. E. Lombard ... 681,128
Fire alarm system, C. E. Lombard ... 681,127
Fire arm, breech-loading, E. Graves ... 680,973
Fireproof book, C. M. Bowman ... 681,097
Fireproof safe, W. Corry ... 681,105
Fire resisting door and door frame, A. De Man ... 680,912
Fish incubator, H. Bourgeois ... 680,838
Flexible tube, C. T. Schoen ... 680,984
Flour, etc., apparatus for mixing, G. S. Baker et al ... 680,832
Flower pot, H. Millingar ... 681,066
Fluid heating and steriling apparatus, Waterhouse & Forbes ... 681,159
Fog horn, L. D. Lothrop ... 680,874
Foundations, construction of, J. Nagy ... 680,803
Fruit picker's sack, A. Hamilton ... 681,169
Frying pan, F. E. Deulin ... 681,044
Fuel compound, D. Jones ... 680,864
Furnace door opening or closing device, Thoele & Moeller ... 680,989
Furnaces, hot water heating attachment for, F. D. Stolz ... 680,744
Fuse or cut-out, electric, L. W. Downes ... 680,968
Game apparatus, M. A. Stelzer ... 680,893
Garment, J. C. Lautenbacher ... 681,061
Gas, apparatus for the manufacture of, W. J. Knox ... 680,788, 680,789
Gas burner, J. Harris ... 681,052
Gas generator, acetylene, M. A. Hamilton ... 680,858
Gas generator, acetylene, A. C. Einstein ... 680,969
Gas generator, acetylene, G. W. Collin ... 681,166
Gas generator, acetylene, B. J. Graham et al ... 681,163
Gas igniting device, automatic, A. Simonini ... 680,813
Gas, manufacturing, J. E. Fry ... 680,770
Gas, manufacturing, W. J. Knox ... 680,782, 680,784
Gas manufacturing system, W. J. Knox ... 680,787
Gas or other explosive engine, A. C. Wolfe ... 681,162
Gas, preparing materials for purifying, J. P. Ihart ... 680,777
Gas producer, G. Westinghouse ... 680,827, 680,828
Gas, producing, W. J. Knox ... 680,785
Gas producing apparatus, W. J. Knox ... 680,786
Gaseous products of combustion, means for utilizing, G. Westinghouse ... 680,826
Gate, B. F. Berkley ... 680,753
Gate and hinge therefor, J. G. Sutton ... 680,896
Gear wheel, Boyd & West ... 680,688
Gearing, speed changing, G. Westinghouse ... 680,825
Germicides, apparatus for automatically applying J. B. Pendleton ... 680,807
Gloves, etc., fastener for, J. V. Washburne ... 681,086
Gloves, etc., fastening device for, W. B. Murphy ... 680,935
Grain drill, T. Carney ... 681,037
Grain tube connection, J. E. Welling ... 680,748
Graphophone and motor, combined, T. H. Macdonald ... 680,794
Grinding device, H. W. Honeyman ... 680,863
Gun cleaner, C. M. Woodman ... 681,163
Harrow, F. Nischwitz ... 680,728, 680,729
Harrow, W. L. Oran ... 681,070
Harrow, flexible, S. D. Poole ... 680,939
Harvester, corn, C. A. Klitzke ... 681,026
Harvester, corn, J. A. Stone ... 681,147
Hat pin, C. W. Lord ... 680,873
Hay fork, F. M. Standley ... 681,146
Headlight signal attachment, A. B. Haller ... 680,773
Heating apparatus, A. Fisher ... 681,019
Heating furnace, W. S. McKenna ... 680,726
Heating furnace, Laughlin & Reuleaux ... 680,997
Hitching post, J. M. Matthews ... 681,129
Hoisting and conveying apparatus, J. L. Potter ... 681,138
Hoisting and conveying device, Miller & Dickinson ... 680,934
Hoisting apparatus, W. A. Petree ... 681,135
Hook. See Logging hook. Snap hook.
Horsehair, manufacture of artificial, F. Lehner ... 680,719
Horse overshoe, Henderson & Taylor ... 681,022
Horseshoe, H. M. McChesley ... 680,801
Horseshoe, O. F. Transue ... 680,948
Horseshoe blanks, machine for rolling, G. Bird, Jr. ... 680,754
House wiring, F. Bathurst ... 680,834
Hubs, lubricator attachment for wheel, W. P. Fergusson ... 680,850
Indigo from indigo leuco compounds, making, A. J. Stiegelmann ... 680,894
Induction motor, alternating current, B. G. Lamme ... 680,792
Iron. See Sad iron.
Jar cover, H. J. Wintherlich ... 680,750
Jeweler's tool, E. A. Simonds ... 681,080
Journal bearing, P. Sweeney ... 680,897
Key. See Calling key.
Knitting machine brake mechanism, F. Wilcomb ... 680,829
Knitting machine bur wheel support, A. Shaver ... 680,945
Knitting machine, circular rib, Williams & Swinglehurst ... 681,161
Labeling machine, R. F. Stahl ... 680,986
Labeling machine, bottle, Gooding & Hausmann ... 680,972
Lamp bracket, transferable clamp, F. S. Armstrong et al ... 680,680
Lamp, jeweler's blast, E. S. Houghton ... 680,921
Lamp socket, incandescent, N. Marshall ... 680,932
Lathe center grinder attachment, H. Dock ... 680,845
Lathe dog, K. G. Holst ... 680,775
Leather stretching device, J. Caldwell ... 680,840
Leather stretching frame, F. H. George ... 680,855
Leather stretching machine clamp, R. L. Braucht ... 680,757
Leather working machine, S. R. Krom ... 680,927
Ledger or account book, H. Elinoff ... 681,046
Ledger, perpetual, A. Pagliughi ... 681,001
Letter box, J. E. Costello ... 680,911
Lifting jack, W. H. Oliver ... 680,730
Lifting jack, W. R. Moore ... 681,029
Linoleum, manufacture of inlaid, D. E. Thomson ... 681,153
Lithographic press blanket, H. G. Bender ... 680,752
Loading coal, etc., machine for, H. J. Seitz ... 681,142
Locking device, F. W. Tobey ... 681,155
Log turner, sawmill, W. N. Elliott ... 681,047
Logging hook or dog, A. Uren ... 680,822
Loom, E. S. Stimpson ... 680,743
Loom, O. Janelle ... 680,778
Loom, needle, Skinner & Connolly ... 681,004
Loom shuttle tension device, A. Baldwin ... 680,682
Loom thread parting mechanism, J. H. Northrop ... 681,069
Loom weft controlling and replenshing mechanism, Baker & Kip ... 681,165
Loom weft replenshing and controlling mechanism, Baker & Kip ... 681,164
Mail box, P. B. Englar ... 680,847
Marker, ground, A. A. Clark ... 681,016
Match holder and ash receiver, combined, F. J. Merz ... 680,933
Mausoleum, C. G. Blake ... 680,908
Measuring machine, warp, G. W. Walker ... 681,157
Mechanical movement, C. P. Cottrell ... 680,765
Metal working machines, tool holder for, J. Quigley ... 681,139
Metallic tubing, flexible, C. Rudolph ... 680,983
Milking apparatus, cow, F. O. A. Weber ... 680,952
Mill appliance, E. E. E. Mears ... 681,065
Milling machines, carriage lowering attachment for, J. F. Crudginton ... 680,962
Mining machine, coal, A. Ball ... 680,6 8
Mold for fibrous articles, M. A. Bland ... 680,837
Motor. See Electromagnetic motor.
Motor meter for alternating currents, A. Peloux ... 681,002
Mowers, manually operated attachment for, H. Green ... 680,915
Nail machinery, furniture, R. A. Breul ... 680,839
Nest, hen's, K. O. Tremere ... 680,821
Nut lock, J. W. Brannon ... 680,690
Nut lock, J. A. Beamisderfer ... 680,835
Nut lock, J. J. Heaton ... 680,861
Nut, screw, W. H. Crosby ... 680,991
Nuts and bolt heads, means for locking, L. Gocht ... 680,709
Oar, P. J. Pool ... 680,885
Odor distributing device, C. T. Bradshaw ... 680,689
Ordnance, percussion firing gear for breech-loading, Dawscon & Buckham ... 681,109
Outlet box, H. Ill ... 680,922
Oven and cooker, solar, M. M. Baker ... 681,095
Package, R. P. Beatty ... 680,684
Packing box, C. W. Lewis ... 680,930
Packing for flanges and stuffing boxes, manufacturing, L. Hauslehner ... 680,860
Pad holder, E. A. Henkle ... 681,118
Pail, milk, J. H. King ... 680,779
Paper, crape, Perkins & Pope ... 681,074
Paste applying device, P. F. Cassidy ... 681,101
Penholder and blotter attachment, F. A. Schlueter ... 680,942
Perforating machine, W. H. Hudson ... 681,121
Phonograph reproducer, E. Karlow ... 681,058
Photographic lens screen, M. A. Seed ... 681,003
Photographic mounts, making, P. J. Stuparich ... 680,947
Pianoforte, A. Medlik ... 680,876
Pilot light, C. D. Crocker ... 681,018
Pipe cutter, A. Katzki ... 680,866
Pit cover, soaking, L. H. Gordon ... 681,115
Pitman rod, L. T. Lake ... 681,027
Planter, corn, G. S. Sheffield ... 680,739
Pliers or kindred tool, H. G. Weibezahl ... 681,160
Plow attachment, W. M. Downen ... 680,846
Plow or cultivator, wheeled, J. R. Babcock ... 681,012
Pneumatic despatch apparatus, J. T. Cowley ... 680,698, 680,699
Pneumatic despatch apparatus, M. Barri ... 681,014
Pneumatic despatch tube apparatus, J. T. Cowley ... 680,697, 680,700, 681,108
Pneumatic despatch tube apparatus, M. Barri ... 681,013
Pneumatic despatch tube apparatus, F. C. Cutting ... 681,042
Pneumatic despatch tube carrier, J. T. Cowley ... 681,041
Pneumatic tube terminal, W. H. Sheppard ... 681,078
Pool table, F. H. Briggs ... 680,759
Post, J. W. Snedeker ... 680,740
Potato digger, P. Geisel ... 681,051
Power press, J. G. Hodgson ... 681,023
Power press, H. M. Lucas ... 681,063
Power shears, G. A. Ohl, Sr., et al ... 680,937
Power transmitting device, F. Grant ... 681,116
Preserving jar, vacuum sealing, E. Norton ... 681,132
Preserving jar, vacuum sealing key opening, E. Norton ... 681,131
Printing press feed gage, T. C. Dexter ... 680,966

(Continued on page 142)

**WOOD or METAL Workers**

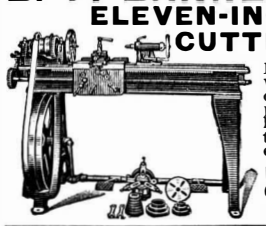


Without Steam Power should use our Foot and Hand Power Machinery. Send for Catalogues
A—Wood-working Machinery,
B—Lathes, etc.
SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

**ENGINE & FOOT LATHES.** MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE & PRICE LIST. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

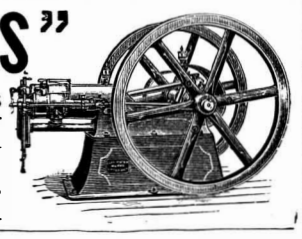
**Foot and Power** and Turret Lathes, Planers, Shapers, and Drill Presses.
SHEPARD LATHE CO., 133 W. 2d St., Cincinnati, O.

**B. F. BARNES—ELEVEN-INCH SCREW CUTTING LATHE**



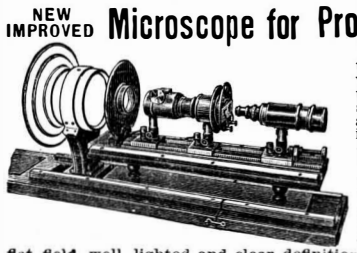
For foot or power as wanted. Has power cross feed and compound rest. A strictly high grade, modern tool. Ask us for printed matter.
B. F. BARNES COMPANY,
Rockford, Ill.

**"OLDS"**



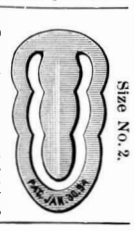
GASOLINE ENGINES are remarkable for SIMPLICITY and ECONOMY
*Write for Prices.*
Olds Motor Works,
1328 Jeff. Ave.,
Detroit, - - Mich.

NEW IMPROVED **Microscope for Projection.**



New metal track plate with keys to unlock standard and change instantly — combining also polariscope and stamoscope. New series of projection objectives, with flat field, well lighted and clear definition. New substage condenser on a new system. Illustrated circular, catalogue, etc., free.
QUEEN & CO., 1010 Chestnut St., Philadelphia, Pa.

**THE EUREKA CLIP**

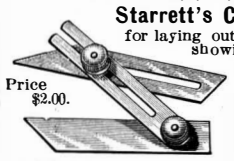


The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**

**BY-THE-BYE, WHEN YOU BUY A BICYCLE**
be sure and buy the best, and that means the
**BUFFALO KING.**

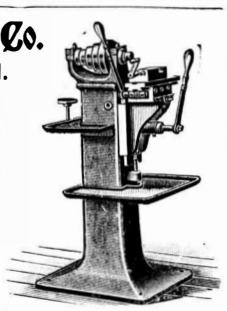
either "Racer" or "Special." The "Queen" is for a lady. No better built wheels on the market—every rider satisfied. Thoroughly up to date in improvements. All parts of best materials. Put together by skilled workmen. Prices, $35 and $40. Illustrated Catalogue free on application.
THE WM. HENGERER CO., Buffalo, N. Y., U. S. A.

**Starrett's Combination Bevel**



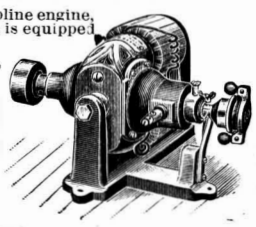
for laying out work, measuring or showing any angle desired
Price $2.00.
Will lie flat. Stock 4 in. long. Catalogue shows many uses of this tool. *Catalogue, 112 pages, free.* The L. S. Starrett Co. Box 13, Athol, Mass.

**Pratt & Whitney Co.**
HARTFORD, CONN.



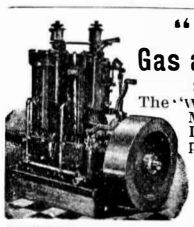
We are prepared to fill orders promptly for various sizes and styles of Milling Machines.
Will be glad to send you our "S. C. I." Catalog fully describing them.
New York, Boston, Chicago, Buffalo, Philadelphia.
You are cordially invited to visit our exhibit at the Pan-American Exposition, Machinery Building, Section No. 38.

The perfect gas or gasoline engine, motor carriage or launch is equipped with the
**Autosparker**



as its sole means of ignition. No Batteries, Belts or Switches.
Write for catalogue
S. A. Address
MOTSINGER DEVICE M'F'G CO.,
Pendleton, Ind., U. S. A.

**"WOLVERINE" Gas and Gasoline Engines**
STATIONARY and MARINE.



The "Wolverine" is the only reversible MarineGas Engine on the market. It is the lightest engine for its power. Requires no licensed engineer. *Absolutelysafe.* Mfd. by
WOLVERINE MOTOR WORKS,
12 Huron Street,
Grand Rapids, Mich.

D. L. HOLDEN
REAL ESTATE TRUST BLDG PHILA., PA.
SOLE MANUFACTURER
**REGEALED ICE MACHINES**
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2 1899


| | |
|---|---|
| Printing press, automatic protector for, T. C. Dexter | 680,967 |
| Printing processes, grating or screen for photomechanical, M. Levy | 680,928 |
| Printing stockings, etc., machine for, R. C. Blood | 680,687 |
| Pulley frame, sash, H. Harig | 680,710 |
| Pulley, self-contained speed varying, F. W. Spacke | 681,145 |
| Pulley, sheet steel, A. E. Brion | 680,691 |
| Pulley, speed varying, F. W. Spacke | 681,144 |
| Pulley, wood, F. W. Gurney | 680,994 |
| Pump, rotary, M. Mauran | 680,722 |
| Pump, steam and vacuum, A. G. Waterhouse | 680,950 |
| Rail joint, W. L. Casassar | 681,038 |
| Rail joint, L. C. Cyphers | 681,043 |
| Railway carriages from injury in case of collision, means for preserving, E. Bachelier | 680,831 |
| Railway crossing frog, E. Poulin, Jr | 681,077 |
| Railway, electric, W. Chapman | 681,039 |
| Railway joint, Perkins & Hill | 681,075 |
| Railway or other wagons, brake mechanism for, J. K. Ewart | 680,768 |
| Railway signaling, F. McBrien | 681,030 |
| Railway system, pneumatic, C. Comstock | 680,843 |
| Railways, contact device for electric, G. Westinghouse | 680,824 |
| Razor strop, E. E. Gerfen | 681,020 |
| Refrigerating and tapping box, J. Irr, Jr | 681,056 |
| Rheostat, T. S. Perkins | 680,808 |
| Rock drill, O. G. Worsley | 681,011 |
| Rolling metal to thin gages, apparatus for hot, T. V. Allis (reissue) | 11,927 |
| Rolling metal to thin gages, hot, T. V. Allis (reissue) | 11,928 |
| Rolling mill, S. V. Huber | 680,978 |
| Rolling mill, automatic sheet metal, E. Norton | 680,998 |
| Rotary engine, J. L. Walker | 680,747 |
| Sad iron, G. R. Ford | 680,970 |
| Saft boltwork mechanism, C. A. Berry | 680,686 |
| Safes, burgler proof device for, Metcalf & Simons | 680,982 |
| Sash fastener, O. Williams | 680,749 |
| Sash lock, J. N. Rees | 680,811 |
| Sash, window, J. C. Weller | 681,009 |
| Sashes, keeper plate for fasteners of, O. Williams | 680,954 |
| Saw set, E. J. Hicks | 681,055 |
| Scale, coupling, C. M. Merrill | 680,796 |
| Scale, weighing, H. G. Roth | 680,888 |
| Scraper, wheeled, C. Rath | 680,886 |
| Screw thread cutting machine, F. W. Forster | 680,971 |
| Sealing can, vacuum, E. Norton | 680,999 |
| Sealing jar, vacuum, E. Norton | 681,130 |
| Sewers or drains, automatic flusher for, P. J. Healey | 680,974 |
| Sewing machine thread cutting device, J. J. Sullivan | 681,149 |
| Shades, automatic drop fixture for, H. M. Sturgis | 681,005 |
| Shaft and pulley coupling, T. White | 681,090 |
| Shoe nail, C. E. Slocomb | 681,143 |
| Sign, L. R. Le Lande | 680,720 |
| Signaling, R. F. Foster | 680,854 |
| Signaling apparatus, R. F. Foster | 680,853 |
| Skein washing machine, R. E. Murphy | 680,878 |
| Skirt and waist supporter, J. C. McDonald | 680,883 |
| Skirt supporter, D. A. Levy | 680,872 |
| Sled, hand, A. A. Towner | 681,156 |
| Sleigh brake, A. C. Patzer | 681,072 |
| Smoking pipe, C. H. Pagett | 680,806 |
| Snap hook, W. H. Munchmeyer | 680,800 |
| Soldering bail ears on bodies of cans or other vessels, machine for, H. N. Norton | 681,000 |
| Sole and heel for boots or shoes, T. Leadbeater | 680,868 |
| Spanner or pipe wrench, D. Stewart | 680,742 |
| Speed indicator, magnetic, S. B. Storer | 680,988 |
| Speed regulator, F. C. Curtis | 680,701 |
| Speed regulator, J. Sturgess | 680,745 |
| Speed varying mechanism, W. S. Halsey | 680,916 |
| Spoke facing and tapering machine, automatic, G. A. Ensign | 681,049 |
| Spool, G. T. Pitts | 681,137 |
| Spring clasp, E. M. Chadsey | 680,763 |
| Spring seat, M. Lally | 681,124 |
| Square, L. S. Starrett | 680,815 |
| Square, J. A. Wray | 680,830 |
| Stacker for threshing machines, Watrous & Van Benschoten | 681,007 |
| Stacker, pneumatic straw, C. W. & E. M. Burton | 680,761 |
| Stacker, portable straw, I. N. Condra | 681,175 |
| Stand, H. H. Fuller | 680,771 |
| Starching machine, W. Hess, Jr | 680,774 |
| Starting apparatus, automatic, G. V. Ellis | 681,048 |
| Steam boiler, F. M. Faber | 680,707 |
| Steam engine, R. J. Patterson | 680,731 |
| Steam generator, G. E. Riblet | 680,736 |
| Steam generator, W. G. Stones | 680,818 |
| Steam separator, vertical, W. D. Labadie | 680,717 |
| Steam trap ejector, W. D. Labadie | 680,718 |
| Steamer, S. H. Coup | 681,106 |
| Steamer, cargo, H. Burrell | 680,692 |
| Store service apparatus, J. T. Cowley | 681,040 |
| Stove hood, J. E. Bell | 680,959 |
| Street sweeper's cart, F. Haberman | 680,856 |
| Stump puller, D. Howell | 681,024 |
| Suspender attachment for waists or shirts, P. A. Chott | 681,102 |
| Suspender end, L. E. Pease | 681,073 |
| Suspenders, G. E. Adams | 680,679 |
| Syringe, vaginal, F. Y. Wilhoft | 681,010 |
| Tag holder, shoe, H. A. Hildreth | 680,975 |
| Telegraph, printing, J. Burry | 680,693 |
| Telegraphy, method by which several telegraphic messages can be transmitted at the same time through one conductor or by wireless, A. Bull | 681,099 |
| Telephone exchange apparatus, F. R. McBerty | 680,879 |
| Telephone exchanges, connection counter for, C. E. Scribner | 680,890 |
| Telephone exchanges, connection register for, F. R. McBerty | 680,880 |
| Telephone switchboards, supervisory signal for, C. E. Scribner (reissue) | 11,929 |
| Thill coupling, J. L. Curley | 680,844 |
| Thimble lid holder, H. Kling | 680,716 |
| Threshing machine picker, F. F. Landis | 681,060 |
| Tie plate, E. Del Manzo | 680,767 |
| Till, F. Day | 680,964 |
| Tire, pneumatic, W. E. Hoyle | 680,776 |
| Tire repairing tool, J. I. White | 681,089 |
| Tire valves, connection piece for pneumatic, J. F. Morrissey | 681,067 |
| Tire, vehicle, F. Theodore | 681,151 |
| Tool rack, R. S. Brown | 681,098 |
| Top, A. C. Backus | 680,957 |
| Toy, C. S. Devaney | 680,703 |
| Toy cannon, R. L. Short | 681,079 |
| Traction engine, J. E. Henris | 680,918 |
| Traction strap, detachable, Maxim & Bardwell | 681,173 |
| Tricycle, etc., J. T. M. Hircock | 680,862 |
| Trolley guide, G. F. Heusner | 680,919 |
| Trolley switch, W. P. Hines | 681,119 |
| Trunk, Snail & Dougherty | 680,892 |
| Tube. See Flexible tube. | |
| Tuning hammer, W. Klinder | 680,926 |
| Twine or cord tension device, C. A. A. Rand | 681,140 |
| Type dressing machine, L. B. Benton | 680,685 |
| Type writing machine, J. H. O'Brien | 680,805 |
| Type writing machine, H. Burg | 681,036 |
| Upholstery apparatus, A. Freschl | 681,050 |
| Valve, L. Schutte | 680,737 |
| Valve, automatic cut-off, M. Koenig | 681,172 |
| Valve device, R. F. Foster | 680,852 |
| Valve for compressors, N. A. Christensen | 680,842 |
| Valve for presses, hydraulic, D. W. Porter | 681,076 |
| Valve, gate, E. D. Jefferson | 680,714 |
| Vault, grave, J. M. Crigler | 680,766 |
| Vehicle, electrically propelled, Newman & Ledwinka | 680,804 |
| Vehicles, safety device for automotor, V. Huberti | 681,025 |
| Vehicles, steering gear for motor, H. R. M. Cormery | 680,764 |
| Velocipede driving mechanism, R. B. Starbuck | 680,741 |
| Vending machine, coin controlled, W. Tribble | 681,084 |
| Ventilating apparatus, W. H. B. Reynolds | 680,887 |
| Virus, machine for impregnating thread with, O. Thomas | 680,898 |
| Wagon bed, G. H. Peterson | 681,134 |
| Wagon jack, J. W. Allgood | 680,751 |
| Washing machine attachment, G. A. Steiner | 680,987 |
| Washing plates or other dishes, machine for, J. Dunner | 681,113 |
| Watch safety attachment, S. Cohen | 681,017 |
| Water heater, W. B. Folger | 680,769 |

(Continued on page 143)


**ESTERBROOK'S STEEL PENS**

*150 Varieties. For Sale by all Stationers.*
There is nothing so good in the way of a pen.
Works, Camden, N. J. THE ESTERBROOK STEEL PEN CO. 26 John St., New York.

**THE THOMAS A. EDISON, JR., INK TABLET**

EDISON'S INK TABLET

will revolutionize the manufacture of ink, because Mr. Edison can produce with his tablet an ink superior in every way to those sold in liquid form, and at one-fourth the cost. One tablet dissolved in one ounce of water produces one ounce of pure ink, which cannot be removed with chemicals or ink eradicators, will not corrode the pen and will make excellent copy. Made in six colors. On sale at all leading druggists. If your druggist does not handle our tablets, write us direct. Sample box of eight tablets and a gold-finished fountain pen, which retails for $1.00, sent, postpaid, on receipt of 50c. If goods are not as represented, money will be refunded. High class agents wanted. Over 1,000 testimonials from Banks and large business firms.

EDISON'S INK TABLET

THOMAS A. EDISON, JR., CHEMICAL CO.,
81-83 Stone Street, New York, U. S. A.

**AUTOMOBILE PARTS.**
IF YOU ARE BUILDING AN AUTOMOBILE, WE CAN SUPPLY YOU WITH PARTS AND FITTINGS.
IN OUR SEVEN FACTORIES WE MAKE RUNNING GEARS, TOOL STEEL BALLS, STEEL RIMS, STEEL STAMPINGS, CHAINS, SHEET STEEL AND FORGINGS.
ALL FOR AUTOMOBILE CONSTRUCTION
QUOTATIONS ON APPLICATION.
THE AUTOMOBILE & CYCLE PARTS CO.
CLEVELAND, OHIO.

**WELL DRILLING Machines**
Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engines or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.
WILLIAMS BROS., Ithaca, N. Y.

SHOE BLACKING.—FORMULAS FOR liquid and solid blacking are given in SUPPLEMENT Nos. **1213** and **1239**. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

**DO YOU USE GRINDSTONES?**

If so we can supply you. All sizes **mounted and unmounted,** always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Ask for catalogue*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

**Our Specialty:** Knock-Down Boats of any description.

AMERICAN BOAT & MACHINE CO.,
ROW, SAIL AND PLEASURE BOATS,
Marine Station. ST. LOUIS, MO.

**BARNES' NEW FRICTION DISK DRILL**
FOR LIGHT WORK.
**Has These Great Advantages:**

The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. Send for catalogue.
W. F. & JNO. BARNES CO.,
1999 Ruby Street, - - Rockford, Ill.

**SUCCESS AWAITS YOU**

**Opportunity Knocks at Your Door!**
**WILL YOU ANSWER?**

Would you realize your ambitions? Would you attain lofty ideals and gain your heart's noblest desires? You possibly love the consciousness of power and wish to win greater honor. Perhaps you desire to mount higher in your accepted calling, or long for a better social position. You may want to turn failure into success—seek love—happiness—friendship.

The secret force that will enable you to accomplish all these things **lies dormant within you.** It only needs developing. All that is attractive in man; all that is powerful for good in his nature; all those qualities which make a man capable of rising in the world, spring from his **Personal Magnetism.**

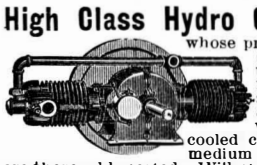
You can develop this great force in a few days at your home without the knowledge of your nearest friends. You can become acquainted with the science that pertains so intimately to yourself—that is so full of startling surprises—that shapes the path of the human will—**that molds the minds of men.**

There is a book that gives you the key to Personal Magnetism; that unveils the secrets of Hypnotism; that lays bare the science of Personal Influence. It is from the pen of the **World's Greatest Authority,** Dr. X. La Motte Sage.

It is sent **absolutely free** to all who ask for it. It is a comprehensive treatise of one hundred pages. Mail a request for the book to-day, you will receive it by **return mail.** A postal card dropped in the box at the corner will bring it to your very door. Address,

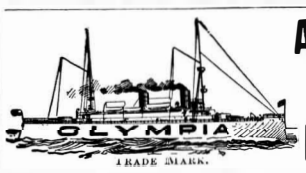
NEW YORK INSTITUTE OF SCIENCE,
Dept. P T 22, ROCHESTER, N. Y.

**High Class Hydro Carbon Motors,**



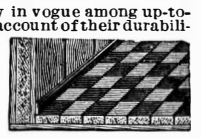
whose production is the result of science, skill, patience, time and money, are manufactured in two sizes, 4 and 5 h. p., and are of the balance type with opposite end air-cooled cylinders. For light and medium weight runabouts and are thoroughly tested. Will start at any time, it makes no difference how cold or warm the weather is. Air and water cooled cylinder. Interchangeable in half hour. Bearings made of best Phosphor Bronze. Length 28 ins.
BRENNAN MFG. CO., Syracuse, N. Y., U. S. A.

**NAME PLATES**
FOR MACHINERY.
We make name plates for some of the largest makers of machinery in the U. S. and we would be pleased to send you sample and quote price. No plate too large or too small.
MURDOCK PARLOR GRATE CO.,
160 Boylston Street, Boston, Mass., U. S. A.




**Asbesto-Metallic Packings**
SHEETING, GASKETS, TAPE and PISTON PACKINGS.
Will stand the highest pressure for either steam or hydraulic work. *Write for samples and price list.*
C. W. TRAINER MFG. CO., (Est. 1874), 88 Pearl St., Boston, U. S. A

**CORK WALLS AND FLOORS**
as well as Cork Ceilings, are now in vogue among up-to-date architects and builders on account of their durability, artistic beauty and economy.

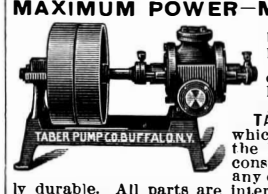


**NONPAREIL CORK**
is water-proof, sound-proof and germ-proof; a non-conductor of heat or cold; noiseless and sanitary and is excellent for decorative ceilings and walls and for the floors of houses, churches, schools, etc., and the decks of yachts, etc.
THE NONPAREIL CORK M'F'G CO., Bridgeport, Conn.

**HAVE THE LATEST IMPROVEMENTS**
No machine shop can be thoroughly up-to-date unless it has the most modern perfected tools. For instance, the

**ASHLEY PATENT NIPPLE HOLDERS**
hold nipples for cutting *either right or left hand* threads. They hold the sleeve from turning and take the strain off both the sleeve and shank thread. Made of best quality cast steel, carefully fitted. Long or short nipples cut with equal facility. The Ashley Holders are of light weight and compact form.
WALWORTH MANUFACTURING CO.
128 TO 136 FEDERAL ST., BOSTON, MASS.

**MAXIMUM POWER—MINIMUM COST.**




If you use a pump for beer, lard, acids, starch, petroleum, brewer's mash, tanner's liquor, cottonseed oil or fluids, hot or cold, thick or thin you want to get the
TABER ROTARY PUMP
which does the most work at the least expense. Simply constructed. Can be run at any desired speed. Perfectly durable. All parts are interchangeable. Needs no skilled workman. Derects guaranteed. *Catalogue free.*
TABER PUMP CO., 32 Wells St., Buffalo, N.Y., U. S. A.

**ELECTRIC FOUNTAINS**
DARLINGTON ELECTRIC FOUNTAIN & SUPPLY CO.
1120 REAL ESTATE TRUST BLDG.,
PHILADELPHIA, PA.

Water meter, L. P. Treadwell..... 681,083
Waterproof fabric and product thereof, making, Posener & Clerke.....680,733, 680,734
Water purifying apparatus, J. Delattre..... 680,992
Watering trough, L. Gist..... 680,772
Wave motor, Banning & Carey..... 680,833
Weaving machine, D. S. Earhart..... 680,705
Well drilling machine, S. J. Reed..... 680,810
Wheel, J. K. Lightfoot..... 681,125
Wheelwright machine, M. L. Knupp..... 681,171
Windmills, power transmitting device for, A. B. Morse..... 680,799
Window, J. C. Weller..... 681,008
Wood, preserving, A. Bevier..... 681,032
Wool fat, extracting, F. W. Robinson..... 680,963
Wool grease, treating, J. Hopkinson..... 680,977
Woven fabric, J. Livingston..... 681,126

## DESIGNS.

Bath tub leg, Ward & Day..... 34,976
Bridle bit, J. G. Ridings..... 34,969
Bottle, C. H. Hess.....34,956, 34,957
Bottle stopple, F. B. Thatcher..... 34,955
Brushes or similar articles, back for, T. W. Foster..... 34,953
Buckle, slide, A. M. Ziegler..... 34,962
Car coupling locking block, J. Timms..... 34,972
Conduit section, J. T. McRoy..... 34,968
Couch rack, H. E. Sheetz..... 34,983
Cushion, C. W. Meinecke..... 34,982
Drilling machine anchor, I. Wantling..... 34,965
Electrotherapeutic device, B. G. Stauffer... 34,964
Fire kindler, E. Pollard..... 34,981
Game board, L. H. Gaines..... 34,985
Garment hooks, eye for, J. W. Granger..... 34,960
Hoe, G. Maurer..... 34,966
Jewel tray, L. E. Sadler..... 34,984
Necktie fastener, O. Kraus..... 34,961
Paper, shelf, W. F. Siegener..... 34,986, 34,987
Shutter slat, J. G. Wilson..... 34,967
Sound concentrator, M. R. Hutchinson..... 34,963
Souvenir plate, M. Tonnemann..... 34,958
Spoke socket, C. L. Rector..... 34,971
Steam generators, header for sectional, C. P. Higgins..... 34,980
Stove, W. H. Cribben..... 34,978
Stove fire pot, A. B. Clunies..... 34,979
Stove, gas, M. Griswold, Jr..... 34,977
Tire and rim, carriage, W. Langmuir.34,974, 34,975
Tire channel rim, vehicle, J. G. Webb..... 34,973
Toilet boxes or similar articles, cover for, T. W. Foster..... 34,954
Yoke plate, E. Einfeldt..... 34,970

## TRADE MARKS.

Baking powder, New Century Baking Powder Co..... 36,931
Baking powder, Black Hawk Coffee & Spice Co..... 36,932
Beverages, certain named, Aktienbrauerei Zum Lowenbrau in Munchen..... 36,925
Biscuits, La Manufacture Dijonnaise des Biscuits Pernot .....36,929, 36,930
Cigars and tobacco, Wm. A. Stickney Cigar Co..... 36,927
Coffee and tea, Black Hawk Coffee & Spice Co..... 36,934
Coffee, G. Amsinck & Co..... 36,935
Corn, flour, meal, bread, bran, rolled oats, semolina, and pollard, W. Vernon & Sons 36,928
Corsets, corset waists, bust supporters, and stays, Classic Corset Co..... 36,897
Cotton or cotton thread, spool, J. P. Coats, 36,903 to 36,906
Cotton or cotton thread, spool, Clark & Co, 36,907, 36,908
Facial preparations, Livengood & Kalbaugh.. 36,914
Glue, E. E. Nice..... 36,944
Grocers' supplies, certain named, Smith Bros. Co..... 36,942
Hair dyes, L. Alexandre..... 36,915
Hair restorers, E. L. Hoffman..... 36,916
Hair tonic, M. E. Mullen..... 36,917
Harness and saddlery, I. Sichel..... 36,948
Lard, syrup, and honey, Aspegren & Co.... 36,937
Liniment, C. A. Robins..... 36,922
Matches, Atlantic Match Co.....36,945 to 36,947
Medicine for the cure of rheumatism, T-Rheumatic Cure Co. ..... 36,918
Mineral water, T. F. Goode..... 36,926
Oils, lard, syrup, and honey, seed, Aspegren & Co..... 36,936
Oils, lard, syrup, dried and canned fruits, and honey, Aspegren & Co....36,938, 36,939
Oils, lard, syrup, dried and canned fruits, and honey, seed, Aspegren & Co.36,940,36,941
Ointment, Potter Drug & Chemical Corporation .....36,921
Paper, William Mann Co..... 36,911, 36,912
Photographic purposes, platinum printing-out paper for, Eastman Kodak Co..... 36,910
Pills, Dr. Wilson Co..... 36,919
Provisions, certain named, Pass Packing Co. 36,943
Resolvent, Potter Drug & Chemical Corporation ..... 36,920
Rubber packing, tubing, and hose, Combination Rubber & Belting Co..... 36,949
Sanitary appliances, certain named, D. P. Sonnehill ..... 36,923
Sewing machines, Illinois Sewing Machine Co..... 36,950
Shoes, McRae & Bevill..... 36,900
Shoes, F. E. Mistrot..... 36,901
Shoes, Smaltz-Goodwin Co..... 36,902
Soap, Wash A Lone Soap Co..... 36,924
Spices, Black Hawk Coffee & Spice Co.... 36,933
Stiffening materials, certain named, Warren Featherbone Co..... 36,899
Suspenders and braces, C. L. Van Doren... 36,898
Toilet preparations, certain named, Octorine Chemical Co..... 36,913
Woven fabric for shades, screens, and curtains, A. C. Hough..... 36,909

## LABELS.

"Dr. Jensen's Catarrh Treatment," for a medicine for catarrh, J. C. Nelson & Co.. 8,604
"F. J. Darlington's Charcoal Chewing Gum," for chewing gum, F. J. Darlington..... 8,614
"Flor de Castillo," for cigars, American Lithographic Co..... 8,616, 8,617
"Force," for cereal food products, E. Elsworth 8,620
"Georgia Watermelon Wine," for wine, F. E. Frey ..... 8,607
"Georgia Watermelon Gin," for gin, F. E. Frey ..... 8,608
"Georgia Watermelon Brandy," for brandy, F. E. Frey ..... 8,609
"Georgia Watermelon Whiskey," for whiskey, F. E. Frey ..... 8,610
"Gold Leaf Lard," for lard, Henry Krug Packing Co..... 8,621
"Henry F. Miller's Enamel and Paint Eraser," for an enamel and paint eraser, H. F. Miller..... 8,623
"Janita," for cigars, American Lithographic Co..... 8,618
"Lily Brand Leaf Lard," for lard, Henry Krug Packing Co..... 8,622
"Manuella," for tea, Milliken, Tomlinson Co..... 8,613
"Medallion," for satin and velvet ribbons, E. Moses & Co..... 8,603
"My Mammy," for whiskey, Henry M. Rubel Co..... 8,611
"Pillsbury's Flaked Wheat Food," for wheat food, Pillsbury-Washburn Flour Mills Co. 8,619
"Rainbow Cocktail Manhattan," for Manhattan cocktails, C. F. Sullivan & Co..... 8,612
"Red Fox Ale." for ale, Massachusetts Breweries Co. ..... 8,606
"Rocky Mountain Sage Bitters," for a medicine, M. Rosenfield & Co..... 8,605
"Shell Border," for cigars, Schmidt & Co... 8,615
"Yellow Label Stove Polish," for a stove polish, Omaha Stove Repair Works..... 8,624

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

**Canadian patents** may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.


**SALARIED POSITIONS FOR LEARNERS**

Write for our **free book** for those who would be **Architects, Civil, Mechanical or Electrical Engineers.** The Schools are open all summer. Over 300,000 students **taught by mail.** Established 1891.

INTERNATIONAL CORRESPONDENCE SCHOOLS, Capital $1,500,000 Box 882, Scranton, Pa.

**ELECTRICAL ENGINEERING TAUGHT BY MAIL.**

Write for our Free Illustrated Book.
"CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute indorsed by Thos. A. Edison and others.
ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 W. 23d St., New York.

**Gas Engine IGNITER**

Complete with spark coil, $12.00. The **Best Thing** on the market. Latest and most improved model.
☞ *Send for Circular.*
Carlisle & Finch Co., 233 E. Clifton Av., Cincinnati, O.

**PUNCTURE PROOF TIRES**

$4.75 SELFHEALING REGULAR PRICE $10 GUARANTEED.

but to quickly advertise them we will send one pair only at $4.75, C. O. D., and you can thoroughly examine them before you advance a cent. **WE PAY EXPRESS ONLY** when cash accompanies order. Send order at once, giving size, and we will forward a pair of the best and most durable tires ever made. CATALOGUE FREE.

Vim Company CHICAGO ILL. COR. RANDOLPH & FIFTH AVE.

Mention SCIENTIFIC AMERICAN.

**TELESCOPES** SEND FOR CATALOGUE W. & D. MOGEY. BAYONNE CITY, N.J.

50 YEARS' EXPERIENCE

**PATENTS**

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

**Scientific American.**

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

**MUNN & Co.** 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.

**PERFORATED METALS**
*FOR ALL USES. MADE AS REQUIRED.*
HARRINGTON & KING PERFORATING Co., 225 N. UNION ST. CHICAGO.

**WORKS LIKE LIGHTNING**

riveting together various articles of Hardware, Mechanics' Tools, Bicycle Chains, Sewing Machine Attachments, Agricultural Implements, etc., at the rate of 1,000 blows per minute. The famous

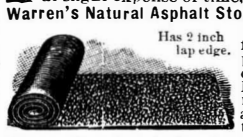
**ELASTIC ROTARY BLOW RIVETING MACHINE**

has no equal of its kind and is a boon to every workshop and factory in the world. Six sizes 1-16 to ¾ inch.
**The F. B. Shuster Co.** NEW HAVEN, CONN. U. S. A.

BICYCLE TIRE REPAIRING.—THE Mending of Single Tube Tires.—A practical article illustrating the method of inserting patches and plugs with pliers and pluggers, together with rubber band plugging and the use of puncture bands. 9 illustrations. Contained in SUPPLEMENT 1102. Price 10 cents. For sale by Munn & Co. and all newsdealers.

**ROOF YOUR OWN BUILDINGS**

at slight expense of time, labor or money with Warren's Natural Asphalt Stone Surface Ready Roofing.




Surface is completed at factory and requires no painting. Durable and comparatively fire-proof. In rolls of 108 square feet, made of genuine Trinidad asphalt. Write for particulars to
Warren Chemical & Mfg. Co., 85 Fulton St., New York.

12-inch Pipe cut off and Threaded with ease by one man and a
**FORBES PATENT DIE STOCK**
Smaller sizes proportionately easy. *Send for Catalogue.*
MACHINE No. 30. Range ¼-2 in. R. & L.
THE CURTIS & CURTIS CO., 6 Garden St., Bridgeport, Conn.

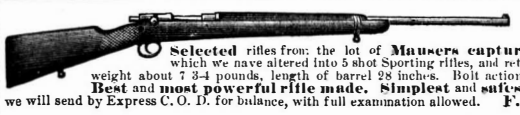
**PREMIUM GOODS FOR EVERY LINE OF TRADE.**

We manufacture the well-known brand of **"Eveready" Electric Light Novelties,** which have become a standard of merit. Look for our trade-mark. Send for our new catalog of novelties and place your order early. Last year we were compelled to refuse orders because they came too late.

Trade Mark Copyrighted.

AMERICAN ELECTRIC NOVELTY & MFG. CO.

AMERICAN ELECTRIC NOVELTY & SUPPLY CO., 255 Centre St., New York, U. S. A.



**$35** Sporting Mauser Rifle for only **$12.85** with box of cartridges.

**Selected** rifles from the lot of **Mausers captured at Santiago** and sold to us by the U. S. Government, which we have altered into 5 shot Sporting rifles, and refinished like **new guns.** In two calibres, 7 mm. and 7.65 mm., weight about 7 3-4 pounds, length of barrel 28 inches. Bolt action, range over 2 miles, penetrating through 1-2 inch steel plate. **Best** and **most powerful rifle made. Simplest** and **safest mechanism.** Limited number for sale. On receipt of $3.85 we will send by Express C. O. D. for balance, with full examination allowed. **F. BANNERMAN, 579 Broadway, New York.**

**MODELS** CHICAGO MODEL WORKS ESTABLISHED 1867 179 E. MADISON ST. CHICAGO, ILL. WRITE FOR CATALOGUE OF MODEL SUPPLIES.

**NOVELTIES & PATENTED ARTICLES**
Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St. Cleveland, O.

**INVENTIONS PERFECTED.**
Accurate Model and Tool Work. Write for Circular.
PARSELL & WEED, 129-131 West 31st St., New York.

**NEW YORK SHOPPING** by a responsible and experienced lady. Send for circular.
MRS. LORD, 10 East 14th Street, New York City.

**ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery.** THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

**$75 Month and Expenses;** no experience needed; position permanent; self-seller. PEASE MFG. CO., Stat'n 10, Cincinnati, O.

**MODELS & EXPERIMENTAL WORK.** Inventions developed. Special Machinery.
E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

STEEL TYPE WHEELS. TYPE WHEEL R. MODELS & EXPERIMENTAL WORK. SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

**Authors and Advertisers** of Articles for Apprentices and Tool Makers and their Employers—I have a valuable Copyright and copies of it for sale. Address
J. E. ALDEN, Gen'l Del. P. O., Buffalo, N. Y.

**MANUFACTURERS OF MACHINERY.**
An offer is desired of a machine for the manufacture of cartridges, shell of pasteboard, for hunting guns having a caliber of 12, 14 and 16, central, and 12 and 16, pin with a daily capacity of 5,000 to 10,000 cartridges. Offer should be accompanied with description of work and addressed "Anbud," care of F. G. Heebergs Annonsbyra, Malmo, Sweden, where samples can be obtained if desired. Correspondence in Swedish and German.

**Cement Books.** How to Use Portland Cement. 50c.; Monier Constructions, Cement & Steel, 50c.; Constitution of Hydraulic Cements, 25c. **Cement and Engineering News,** 162 La Salle St., Chicago.

**Experimental & Model Work**
*Cir. & advice free.* Wm. Gardam & Son, 45-51 Rose St., N.Y.

**LIGHT MANUFACTURING**
AND EXPERIMENTAL WORK.
SPECIAL MACHINERY. AUTOMOBILE PARTS.
OTTO KONIGSLOW CLEVELAND, OHIO.

**MODEL AND EXPERIMENTAL WORK.**
Electrical and Mechanical Instruments. Small Mach'y.
EDWARD KLEINSCHMIDT, 122 Fulton St., New York.

VOLNEY W. MASON & CO.,
**Friction Pulleys, Clutches & Elevators**
PROVIDENCE, R. I.

**FELTEN & GUILLEAUME CARLSWERK**

Actien-Gesellschaft, MÜLHEIM-ON-RHINE, GERMANY.

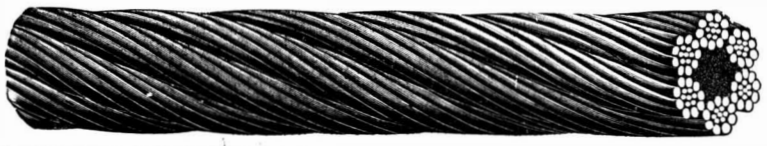
**Iron, Steel, Copper and Bronze Wire Drawing Mills, Wire Ropery, Wire Goods and Netting Factory. Galvanizing Shops, Copper Smelting Works, Cable Factory for Telegraph, Telephone and Electric Light Cables, Insulated Wires, Dynamo Wires, Technical India Rubber Goods.**

**Oldest and most renowned Wire Rope Factory on the European Continent.**

**Wire Ropes of the Latest and Most Improved Systems**
IRON, STEEL and COPPER.

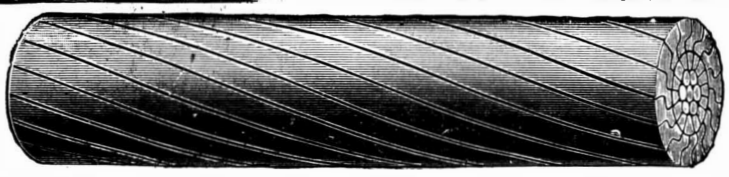
**ROUND AND FLAT WIRE ROPES**
for Mining, Hauling, Driving, Lifting, Tramways, Inclines, Towing, Sash Lines, Cranes, Etc., Etc.

**ALBERT or so-called LANG'S LAY ROPES**
for Mining, Traction, Ropes for Aerial Tramways, Etc., Etc.



**PATENTED FLATTENED STRAND WIRE ROPES.**
Specially adapted for Mining Ropes, Traction Ropes, for Aerial Tramways, Lift and Crane Ropes, Etc.

**LOCKED COIL WIRE ROPES.**
Specially adapted for Carrying Ropes for Aerial Tramways, Winding Ropes in Mines, Hauling Ropes for Inclines, Etc., Etc.



**All Kinds of Conducting Material for Telegraphy, Telephony, Electric Light, Power Transmission & Electrical Tramways.**

**Agents:** T. H. BUNNELL & CO., 20 Park Place, New York.
WATSON, JACK & CO., 7 St. Helen St., Montreal.

THOROUGH INSPECTIONS

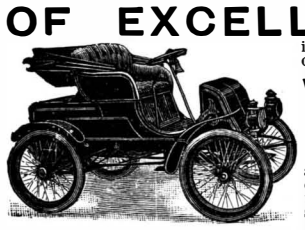
HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, PRESIDENT · W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY · F. B. ALLEN, 2D VICE PRESIDENT
L. B. BRAINERD, TREAS. · L. F. MIDDLEBROOK, ASST SEC'Y

FIVE POINTS OF EXCELLENCE



in the construction of the famous

WINTON MOTOR CARRIAGE

are (1) beauty of design, (2) perfect mechanism, (3) strength of build, (4) absolute safety and (5) attention to detail. Made by the most skilled workmen; super-intended by brains and experience. All parts are inter-changeable. Hydro-Carbon System.

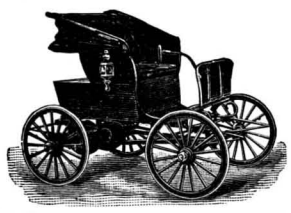
PRICE $1,200.

☞ *Catalog free on application.*

THE WINTON MOTOR CARRIAGE CO.,
486 Belden Street, Cleveland, Ohio, U. S. A.
EASTERN DEPOT, 150-152 East 58th Street, New York.

"THIS WILL CARRY YOU"

30 Miles On One Charge . .



MADE BY

SCOTT AUTOMOBILE COMPANY
3927-3939 OLIVE STREET,
ST. LOUIS, U. S. A.
Manufacturers of Reliable Storage Batteries.
*Write for Prices.*

CRUDE ASBESTOS
AND ASBESTOS FIBRE

MINES and WORKS, THETFORD, P. Q. CANADA.

R. H. MARTIN, OFFICE, ST. PAUL BUILDING, 220 B'way, New York.

WATCHES!

No advertisement can properly portray the striking effects produced in our watches. They are illustrated in our BLUE BOOK showing Ladies' Watches in all metals and exquisite enamels; our RED BOOK showing Men's and Boys' Watches with up-to-date attractive designs. Either Blue or Red Book sent on application.

THE NEW ENGLAND WATCH CO.
37 & 39 Maiden Lane, New York City. 149 State Street, Chicago.
Spreckels Building, San Francisco.

A Longed-for Lubricant

which wheelmen will greatly appreciate and which, besides easing the running, will save much wear and tear on the machine is

DIXON'S CYCLE GRAPHITES.

For Chains, Gears or Coasters.

Send 10 cents for sample stick or tube.

JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.

If it isn't an Eastman, it isn't a Kodak

KODAK

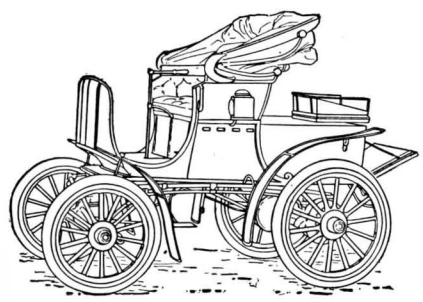
quality and Kodak film quality have made the Kodak way the sure way in picture taking.

EASTMAN KODAK CO.

*Catalogue free at the dealers or by mail.* Rochester, N. Y.

If it isn't an Eastman, it isn't a Kodak

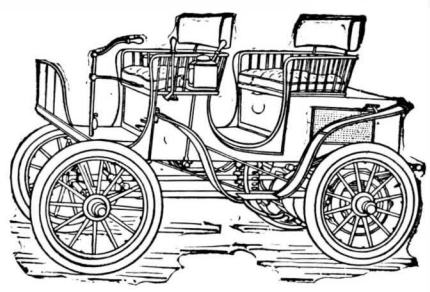
Columbia AUTOMOBILES



ELECTRIC—GASOLENE

The superiority in capacity and durability of the new exide batteries, with which we are equipping all our electric vehicles, doubles their radius of reliable action.

. . . FORTY MILES ON EACH CHARGE . . .



Electric Vehicle Co.,
100 BROADWAY, N. Y.

Western Agency and Showrooms:
267 WABASH AVE., CHICAGO.

WRITE FOR 1901 ILLUSTRATED CATALOG.

ENGINEER'S LICENSE. SENT FREE.

MECHANICS, ENGINEERS, FIREMEN, ELECTRICIANS, Etc.
40-page pamphlet containing questions asked by Examining Board of Engineers.
GEORGE A. ZELLER, Publisher,
Room 335, 18 South Fourth St., St. Louis, Mo.

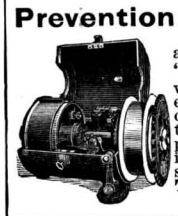
A long distance delivery wagon with tank and oil supply for running 200 miles. Entire body available for carrying space. Very powerful motor, strong running gear and elegant finish.

Price $1,200.

LOOMIS AUTOMOBILE CO.
Westfield, Mass.

Model No. 3.

Prevention Better Than Cure.



The largest plants in the country are using the "MONARCH" Engine-Stop System with which it is impossible for an engine to run away. Invaluable in cases of accident or emergency, as the engine can be stopped from any portion of the plant by simply pressing an electric button. Safe, swift, sure. Superiority commands respect.
THE MONARCH MFG. CO.
Waterbury, Conn.

EAGLE
Acetylene Generators
ARE PERFECT.
Over 10,000 Machines Sold.

They are endorsed by every user.

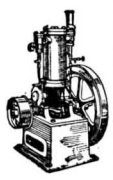
Send for prices.
Handsome illustrated catalogue.
District Representatives all over the world.

EAGLE GENERATOR COMPANY,
319 N. 4th Street,
St. Louis, Mo.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

CHARTER ENGINE

USED ANY PLACE BY ANY ONE FOR ANY PURPOSE

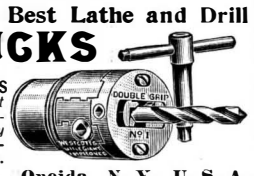


FUEL—Gasoline, Gas, Distillate
Stationaries, Portables, Engines and Pumps, Hoisters
*Send for Catalogue and Testimonials.*
☞ State Your Power Needs

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

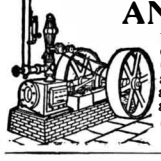
If You Want the Best Lathe and Drill CHUCKS

BUY WESTCOTT'S *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*



Westcott Chuck Co., Oneida, N. Y., U. S. A.
*Ask for catalogue in English, French, Spanish or German.*
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

ENGINES, BOILERS AND MACHINERY.



When you want good rebuilt machinery at bargain prices, write for our **Catalogue, No. 323.** We carry all kinds of engines (gas, gasolene and steam power), boilers, pumps and mill supplies in general.
CHICAGO HOUSE WRECKING CO.,
West 35th and Iron Sts., Chicago.

RUST ON GUNS TOOLS & CYCLES PREVENTED BY MANNOCITIN
C. H. BESLY & CO. CHICAGO ILL. U.S.A.

BRISTOL'S RECORDING INSTRUMENTS.

Pressure Gauges, Vacuum Gauges, Voltmeters, Amperemeters, Wattmeters, and Thermometers, make continuous records *Day and Night.* Will pay for themselves. Every instrument fully guaranteed and sent on 30 days' trial. ☞ *Send for Circulars and Specimen Chart.*
The Bristol Company, Waterbury, Conn.
SILVER MEDAL PARIS EXPOSITION.

"Light of Asia"
THE MOST BRILLIANT AND LASTING
Portable Electric Lamp.
"CLOVER LEAF" Dry Batteries, Test Sets, Cells and Automobile Lamps.
ELECTRIC CONTRACT CO.,
53 MAIDEN LANE.

SMALL STEEL CASTINGS
That are Moulded True to Pattern.
That are of Tough and Uniform Metal.
That are Easily Machined (No hard spots).
That are Free from Blow or Sand Holes.
That will take a Fine Polish.
That will Harden like Tool Steel.
Send Samples for Prices Stating Quantity Required.
HOMER F. LIVERMORE, 80 Pearl St., Boston, Mass.

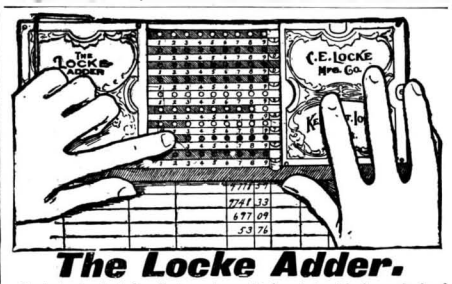
THE COLUMBIA EXPANSION STEAM TRAP

Patented September 4, 1900. Patented April 10, 1894.

**Is a Wonder.** All made to work from 0 up to 150 lbs. steam pressure and tested on steam before shipment. Also manufacturers of McDaniel Steam Traps, Separators, Reducing Valves, Exhaust Heads, Blow-off Valves, Suction Tees, Hydraulic Valves. Sold by dealers. Send for booklets.
WATSON & McDANIEL CO.,
145 North 7th Street, - Philadelphia, Pa.

STEWARD'S WONDER

is the highest class Acetylene Gas Burner. All Lava Tips. A new argand burner $2.50—highest candle power obtainable. Correspondence solicited.
STATE LINE MFG CO., Chattanooga, Tenn., U. S. A.
Eastern and export office, 107 Chambers St., New York.



The Locke Adder.

Fastest, simplest, handiest, most practical and durable low-priced calculating machine. No business complete without it. Adds, Subtracts, Multiplies, Divides. Easily learned, lasts a lifetime. Saves time, labor, money, and

QUICKLY PAYS FOR ITSELF

Ensures accuracy, releases from mental strain. Adds all columns simultaneously. Capacity 999,999,999. Price $5.00 prepaid. Descriptive booklet FREE. Agents wanted.
C. E. LOCKE MFG. CO. 25 Walnut Street, Kensett, Ia.

Remington Typewriters

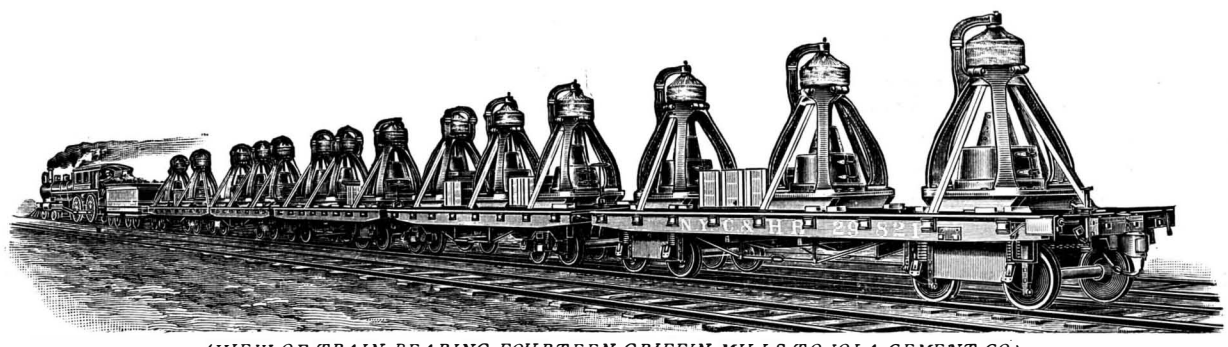
are used by the heavy users

This is the supreme test of a typewriter. Good work on a brand new machine proves little or nothing. But it takes a first-class typewriter to **keep doing good work,** year after year, under the heaviest kind of service.

This is the secret of Remington supremacy. It accounts for the universal preference shown for the Remington by experienced users.

Wyckoff, Seamans & Benedict,
327 Broadway, New York.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
Wm JESSOP & SONS Ltd 91 JOHN ST. NEW YORK



*(VIEW OF TRAIN BEARING FOURTEEN GRIFFIN MILLS TO IOLA CEMENT CO.)*

"MOST SATISFACTORY AND ECONOMICAL."

IOLA PORTLAND CEMENT COMPANY.

DETROIT, MICH., Oct. 16, 1900.

BRADLEY PULVERIZER CO., Boston, Mass.

*Gentlemen:*—Your inquiry as to the satisfaction the Griffin Mills are giving us duly received. We have forty-two 30 in. Griffin Mills in our plant. The writer has had a large experience with most kinds of grinding machinery, and is prepared to say that for grinding Portland cement clinker the Griffin Mill is the most satisfactory and economical grinding machine on the market. Each of the above mills has at times run over ten barrels per hour, and on long runs has averaged nine and a half barrels each per hour. Yours truly, IOLA PORTLAND CEMENT CO.,
(Sgd.) Per JOHN T. HOLMES, *Managing Director.*

We invite everyone interested in reducing refractory substances to an even degree of fineness to write for descriptive catalogue of this remarkable mill. It will surely interest you and may save you money.

THE BRADLEY PULVERIZER CO., BOSTON.